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Connections?
We Review 13
Low-Cost LANs

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Ever Wanted to
Know About
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Fastest PCs
Ever: First
Looks at

**90-MHz
Pentium
PCs**



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MAGAZINE**

Mean Green Machines

**38 Fast, Energy-
Efficient, and
Surprisingly
Affordable PCs**



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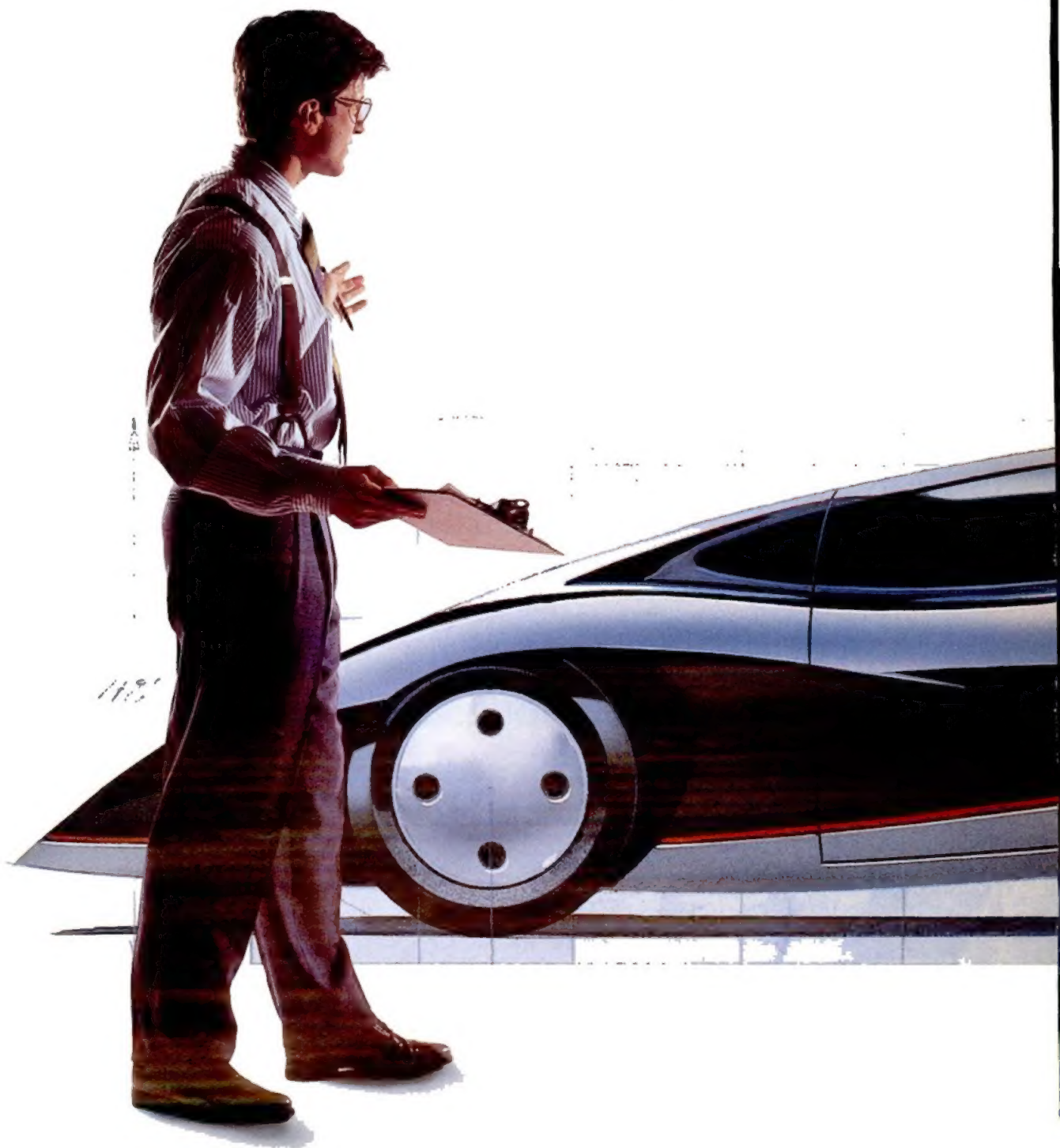
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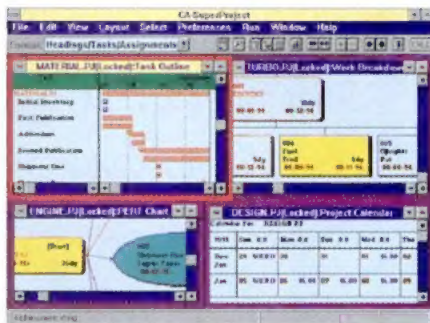
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CIRCLE 026 ON READER SERVICE CARD

Inside

You shouldn't be surprised to discover that people don't mind being "ecologically correct" as long as it doesn't cost them anything. But it might surprise you to find out that the current crop of energy-efficient PCs can save on power consumption with-

out skimping on performance. And it will probably surprise you even more to know that saving energy won't cost you an extra dime.

How do we know? We just plowed our way through evaluating 38 Energy Star PCs ranging from 486SX/33s to 486DX2/66s. In addition to running our usual

is sitting idle. As our story "Power to the PC" tells you, this translates into considerable savings.

Why not just turn your PC off when you're not using it? Because more and more, we're using our personal computers around the clock, for things like polling e-mail and sending faxes at off-peak hours, and doing nighttime back-

ups. Thanks to the efforts of PC Magazine Labs project leader Tami Peterson, who was assisted by Dan Begun, Deval Shah, Peter Bastide, and Charlie Rodriguez, we learned that it's possible to keep your PC working overtime without taxing the environment or your pocket-book.



PC Labs' Peterson, Begun, Bastide, Shah, and Rodriguez ask the question, "What is watt?"

suities of benchmark tests, we developed a test methodology that measures the amount of current that a PC draws. We discovered that each of the new energy-efficient PCs draws about the same 150 watts of current that a traditional PC draws under normal usage. But each of these new PCs has a sleep mode—much like a portable computer's—that cuts power consumption down to about 60 watts when the machine

Speaking of working overtime, our graphics team sorted through the digital-video morass, taking a look at video-capture boards and video-editing software. Read "Reel to Real" if you're ready to start dabbling.

And the networking team evaluates peer-to-peer solutions. In a year when Microsoft Windows for Workgroups is making lots of noise, the team's findings may surprise you.

—Robin Raskin

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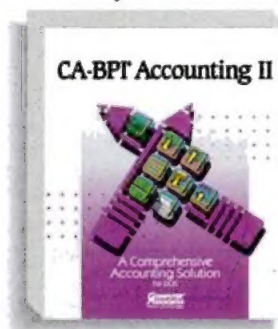
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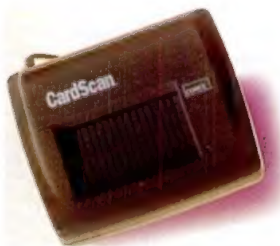
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Energy Star PCs

Power to the PC

BY BRIAN NADEL

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doesn't have to mean low performance. The 38 new PCs that we look at here aim to give you the best of both—and still meet the Environmental Protection Agency's Energy Star guidelines114



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The Works: Not Just for Beginners Anymore

BY STEVE GILLILAND AND
TED STEVENSON

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Video Capture and Editing Software
Reel to Real

BY JAN OZER

Still think of video on the PC as full-motion postage stamps? That's no longer the case, thanks to better capture boards and compression schemes. And when the time comes to put the pieces together, a wide range of video-editing software is available to add your favorite transitions and effects. You still won't be cutting music videos for MTV, but you'll certainly be able to impress everyone with the quality you put into your lively multimedia presentations. Our look at seven capture boards and five editing packages can help you decide how video can fit in with your business211

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Peer-to-Peer
LANs:
Peer Pressure

BY FRANK J. DERFLER, JR.

Still a good connectivity solution for many small sites, peer-to-peer networking packages come with a wide range of capabilities. Some handle only simple file and printer sharing; others are powerful operating systems that rival server-based LANs. Many use standard Ethernet hardware; a few continue down the proprietary route. But nearly all have newer interfaces and more powerful communications tools, giving users a better crop than ever from which to choose237

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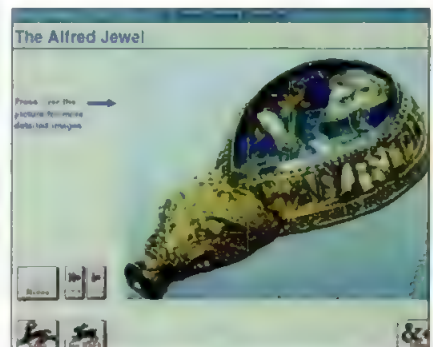
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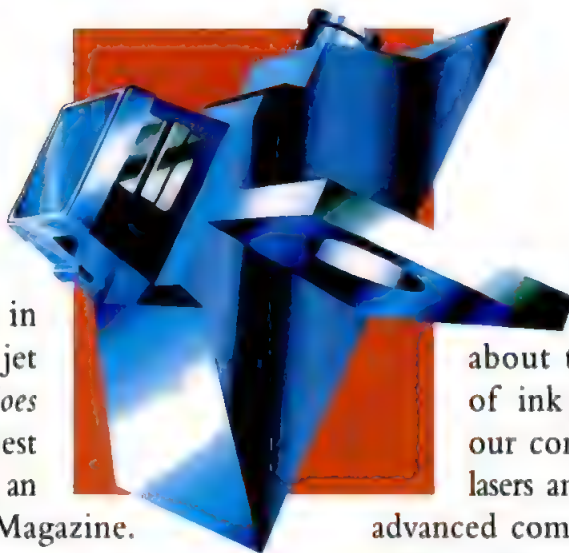


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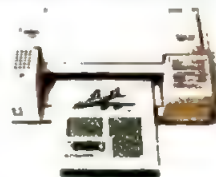
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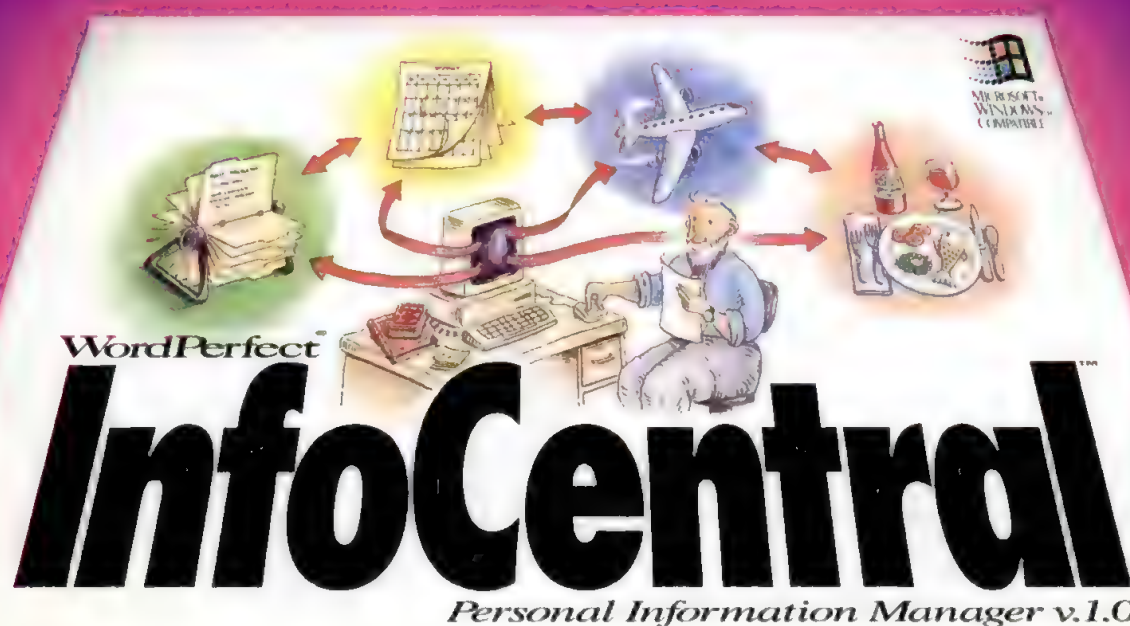
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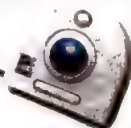
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Letters

A BRAVE NEW CD-ROM WORLD

"The World of CD-ROM"—your February 22, 1994, roundup of 26 CD-ROM drives—was interesting, but very few of the drives reviewed are commonly available in mass-merchandising stores like Sears, Best Buy, Wal-Mart, Software Etc., and so on. Proprietary drives appear to do as good a job as CD-ROM units, and I would be very interested in seeing how my Creative drive (a Panasonic model) and my friend's Mitsumi stack up against the SCSI drives (and the one proprietary Sony drive) in your review.

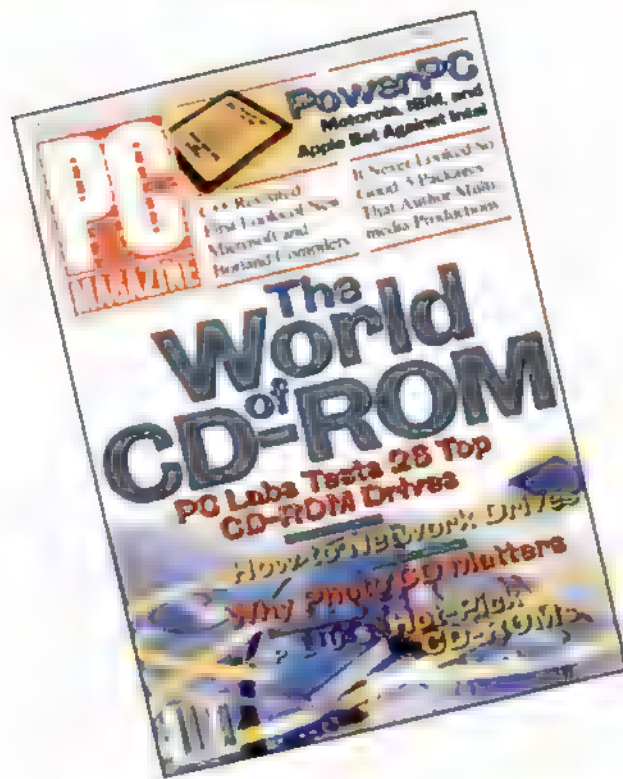
*Robert Glover
via PC MagNet*

• Because of the size of the category, we opted to review CD-ROM subsystems (drives with controllers). Later this year we will look at multimedia upgrade kits (sound boards accompanied by CD-ROM drives).—Ed.

One important consideration that was absent from your CD-ROM drive roundup was the resource requirements of each CD-ROM's driver. When I was looking to purchase a double-speed drive, I had to choose between a unit whose driver would take up 49K of memory and a unit that only needed 11K of memory. The 38K I would have had to give up to run the unit with the more resource-hungry driver would have required me to boot my system several ways to enjoy all the different kinds of software I use. The 11K driver lets me simply boot my system and run whatever programs I want to run.

*Jim Mayhew
via PC MagNet*

Why would anyone who uses PC equipment for real work want to bother with a CD-ROM drive? To play audio CDs on lousy speakers? I have a \$300 CD player with decent speakers in my office and enjoy quality music all day long. To look at videos of a limited number of items in a jerky sequence on a small monitor? I would rather watch the video on my TV set with a VCR. For reading encyclopedias and similar reference material? Much



*Why would anyone who
uses a PC for real work want
a CD-ROM drive?*

of the technical reference material I use isn't available on CDs. For storing and playing back slide shows for seminars? Now, there's an idea, but I'd need a costly CD-R drive to write to a CD. Only when I can draw the slides, put them on the disk, take them to the conference center, and play them back on the projection equipment can I see a point to CD-ROMs. Until then I think CD-ROM is just a toy.

*Clyde E. Stauffer
via PC MagNet*

WISHING ON A CD-ROM

Bravo to Robin Raskin for her picks of good CD-ROM titles (Pipeline, "Hot Picks to Get You Going," February 22, 1994). I only wish the topic had been given another page, since the reason users buy CD-ROM drives is the great software that's available.

*Myles Callum
Jersey City, New Jersey*

INTERFACING WITH INTERFACES

In "Good Interfaces: Rich or Spare?" (February 8, 1994), Jim Seymour stated, "I like Lotus Organizer, and much of what I like about it is that graphical representation of a familiar, Filofax-style daybook."

Though that format is useful, there is

nothing more limiting than a piece of paper. Using the computer to simulate the real world makes insufficient use of the innovations and capabilities behind the computer technology on which a graphical interface is based. We'll never progress if we don't look beyond the familiar.

*Jorge Vismara
via PC MagNet*

TIME TO CHANGE THE PICTURE

As an artist, I read your January 25, 1994, reviews of illustration software, "A Picture in Time," with ongoing frustration. With all the technology now available, I can have a system that provides 16.7 million colors—more colors than it is humanly possible to discern; a system that is capable of calculating the intensity, hue, and value of each of these colors more quickly than it is humanly possible to imagine; a system that can scan and interpolate at resolutions higher than it is humanly possible to see. But what's the point of having all this wonderful software and processing power if artists must still put up with junky input devices? I find it ironic that the intuition and expression that goes into the design of this software has never been extended to the input devices used with it.

*Frederick A. Lepine
Hay River, Canada*

JOHN C. DVORAK, UGLY AMERICAN?

I'm glad that John C. Dvorak has alerted us to the hordes of shabby, technologically illiterate, nicotine-stained foreign wannabes lurking about the convention center at Fall Comdex ("Comdex Lament," February 8, 1994). It's great to know that the Ugly American epitomized in William J. Lederer and Eugene Burdick's 1958 novel is still alive and well.

*Lowell Kosloskey
via PC MagNet*

CAUTION AHEAD

Here's a warning to anyone who plans to use Microsoft Word 6.0 for Windows (First Looks, January 25, 1994; "Suite Deals," February 8, 1994): Be prepared to get a 1GB hard disk.

When I converted a 2,560-byte Word

Remember when color TVs suddenly became affordable? Can you say déjà vu?

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LETTERS

5.0a for DOS file (a one-page, two-paragraph letter with nothing fancy) to the Word 6.0 for Windows format, the file's size swelled to over 11K. That's almost five times as large as the original DOS file size. I thought the conversion process might be to blame, so I created a new document in Word 6.0 for Windows that simply consisted of the single, lowercase letter *a*. According to the File Manager, this lengthy dissertation occupied 6,655 bytes. There is no way I can afford products like this if they are going to hog my hard disk space.

*Dick Lambert
via PC MagNet*

JUST THE REXX

How refreshing to see a review of an OS/2 product like Watcom VX-REXX, Version 1.01, amidst the other products in your evaluation "Cross-Application Macro Languages" (February 8, 1994). This is certainly a topic that's worth more attention. The utility of the applications in part determines what operating system I decide to run.

Of course, it would have been nice if you had included a couple of VX-REXX's OS/2 competitors. REXX is one of the great unrealized strengths of OS/2. As the major manufacturers gear up for proprietary macro languages for their own products, the general use of REXX in OS/2 products offers a glimpse of how advantageous a standard can be to the end user.

*J. Lederer
via PC MagNet*

• We would have liked to cover more REXX products, but at the time of our roundup only VX-REXX had the capabilities needed to get through our test script. (HockWare's VisPro/REXX Gold Edition, an interesting new contender, was not yet being shipped.) VX-REXX was an Editors' Choice winner not because it was the only OS/2 tool tested, but because it is one of the best tools we've seen, regardless of environment.—Ed.

SWEET SUITES

While the power of the applications reviewed in your February 8, 1994, cover

story, "Suite Deals," was certainly evident, so were their hefty prices (\$595 to \$995) and resource requirements (anywhere from 16MB to 89MB of hard disk space). I find it surprising that some people are touting these bundles as true bargains. Really? What am I supposed to do, get a new hard disk just so I can handle "bargains"? You've already covered high-end word processors, spreadsheets, and databases in recent issues. Why not cover integrated packages like Claris Works, GeoWorks, Lotus Works, and Microsoft Works as well? Please keep value-conscious folks in mind.

*Duane Char
Bothell, Washington*

• For an in-depth look at integrated packages, see "The Works: Not Just for Beginners Anymore" in this issue.—Ed.

I enjoyed your survey of software suites in the February 8, 1994, issue, but I was amazed to see the complaints in this column criticizing the coupons with Microsoft Office. I purchased Office and registered for the missing software via a phone number on the back of the coupon. Meanwhile, I installed the suite and utilized all the programs. Sure, I didn't get the new copies of Excel and PowerPoint right away, but the other day Federal Express was here, and all I had to do was sign for Excel 5.0.

*Jay Armstrong
via PC MagNet*

STOP BY OUR BOOTH

In a February 8, 1994, letter to the editor, Ed DeJesus responds to Bill Machrone's column, "Trade Show Travails" (November 23, 1993), in which Machrone takes a stand against using sex to sell products at trade shows. Mr. DeJesus agrees with Machrone's statement that in condemning the trade show models we are "blaming the victim."

Oh, please. While I agree that using sex to sell computers is wrong, I can hardly believe that the women employed at the shows are "victims." Nobody forced these women to take these jobs. Let's try to keep focused on the real problem, shall we? The problem is indeed with the employers and not the employees.

*Dan Thomas
via PC MagNet*

CORRECTIONS AND AMPLIFICATIONS

In the review of the Nanao FlexScan F780iW monitor (First Looks, "Nanao's 21-Inch FlexScan: A Flicker-Freezing Wonder," March 15, 1994), we misstated the source of Energy Star guidelines. The source is the Environmental Protection Agency.

The correct phone number for Bright Ideas (Trends, March 15, 1994), a consulting company that helps parents select educational software, is 508-371-9040.

All of the performance graphs on page 297 of the March 15, 1994, story "Application Servers: At Your Service" should have contained the legend "transactions per second."

The correct toll-free number for Traveling Software, vendor of LapLink Wireless (First Looks, March 15, 1994), is 800-343-8080.

In a sidebar to the story "PowerPC: Your Next CPU?," we erroneously included DeskStation Technology in a list of vendors that build systems based on Digital Equipment Corp.'s Alpha processor. The company should have been included in the list of vendors that use the MIPS R4000 processor family. PC Magazine Labs will review a DeskStation system based on the Orion R4600 processor in the issue of May 31, 1994.

HOW TO WRITE TO PC MAGAZINE

We welcome your comments and suggestions. Please send correspondence to Letters, *PC Magazine*, One Park Ave., New York, NY 10016-5802, or upload it to PC MagNet (see page 12 for access information). Electronic mail may also be sent to individual editors. Type GO PCM-STAFF on ZiffNet for a list of addresses. All letters become the property of *PC Magazine* and are subject to editing.

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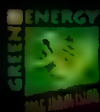
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But still you have your doubts. What exactly is this new technology? And what's in it for you?

Well, it's called GDI printing and it works like this. GDI (Graphical Device Interface) is the native language of Microsoft Windows.™ Because the SuperScript 610 thinks and speaks the same language it doesn't have to translate or reformat your documents before it can print. Which means it's 30% to 300% faster than ordinary printers. And what you see on the screen is truly what you get.

Okay, this is obviously a great Windows printer. But can it print PCL and DOS? Of course. As long as you open the application from within Windows. There's even a \$99 PostScript™ option if you need it.

With all this sophisticated technology, you'd expect the 610 printer to be complicated and hard to use. But it's actually much easier to use than ordinary printers. And it only takes minutes to install.

To achieve this kind of ease we did have to eliminate a few things, however. Like the controller. Why have one when the PC can do the file processing? It's faster and more efficient. It also allows you to print fonts and graphics without any limitations. And every time you upgrade your PC, you automatically upgrade your printer.

We also moved the operator panel to the PC screen — where it belongs. That way graphical displays and animated icons can show you exactly what's going on at all times.



By the way, the SuperScript 610 is extremely compact, 300 dpi, prints 6 pages per minute and it comes with a 2-year overnight replacement warranty.

And it only costs about \$600. What's so hard to understand about that? For more information, call 1-800-NEC-INFO or for details via fax, call NEC FastFacts™ at 1-800-366-0476, and request document #SW610.

CIRCLE 217 ON READER SERVICE CARD

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CIRCLE 117 ON READER SERVICE CARD

Trends

TRENDS & TECHNOLOGY SHAPING THE PERSONAL COMPUTER MARKET

Pentium's Progress

Second generation Pentiums run cooler.

On March 7, Intel announced its second-generation Pentium chip, code-named P54C, months ahead of schedule. Sources say Intel wanted to take the wind out of Apple's PowerPC sails. At a conference for electrical engineers Intel described the technology behind this new Pentium and gave a glimpse of its future by demonstrating

a Pentium running at 150 MHz. (See this issue's First Looks section for reviews of PCs built around the new Pentium.) Based on a 0.6-micron manufacturing process, the new Pentium will use 80 percent less power than the original Pentium, says Intel. Engineers achieved this by using transistors that are 0.6-micron wide, as opposed to the 0.8-micron transistors of the first Pentium chip. In microprocessors, smaller transistors mean there's a shorter distance for the electrons to travel. That shorter distance translates into faster performance.

A new four-layer process adds to power conservation. While most processors comprise three layers of metal, this one has four layers. Intel says the extra layer distributes the power across the chip from the periphery. It operates at 3.3 volts—down from 5—and draws about 4 watts while running at 100 MHz and 6 watts at 150 MHz. This is far less than the 14 watts the first Pentiums required. The chip also runs cooler at 3.3 volts.

The new Pentium has a programmable clock generator that supports a number of different internal-to-external frequency ratios—2:1, 1.5:1, and 1:1. This means that



PC makers can put the 90-MHz and 100-MHz versions of the new Pentium on systems running 60-MHz or 50-MHz bus speeds. The variable clock makes it possible for Intel to release Pentium chips at a variety of speeds. The first to arrive are 90-MHz and 100-MHz Pentiums; 133-MHz and 150-MHz models are on the horizon.

Intel's chip proliferation strategy has also yielded the new clock-tripled 486 DX4 and the upcoming P24T, an overdrive chip that turns a 486 into a Pentium. But what's beyond the Pentium? Andy Grove, Intel's CEO, says the P6 will be available in late 1995. Grove says it will be compatible with today's 486 and Pentium chips but will pack over 6 million transistors on the silicon—double the Pentium's.—Christopher Barr

Compression Casualties

WHEN THE SMOKE CLEARED after the Stac Electronics vs. Microsoft trial, the disk compression software market had been permanently scarred. Two key decisions made by the jury set off a chain of events that left Microsoft without a compression engine and left the state of Stacker very much in doubt.

Fact: The federal jury found that in DoubleSpace, Microsoft had violated two Stac patents on data compression and had to pay Stac \$120 million in damages.

As a result, Microsoft released DOS 6.21, which does not contain DoubleSpace. Users of DOS 6.0 and 6.2 can continue to use DoubleSpace without any legal consequence.

Microsoft filed a motion asking the judge to overturn the jury's patent-infringement verdict. If the judge does not, Microsoft will file an appeal.

Fact: The jury found Stac guilty of reverse engineering a feature in DOS 6 that lets DoubleSpace (and Stacker) "preload" the compression driver before CONFIG.SYS and AUTOEXEC.BAT run. Preloading is a significant advance that only an operating system developer could have introduced. The jury ordered Stac to pay Microsoft \$13.7 million in damages.

Because Stacker 3.x and Stacker 4.0 use the preloading technique, Microsoft wants to stop the sale of all Stac products that preload the driver and has asked for an injunction. If Microsoft is granted the injunction, Stac would have to release a version of Stacker that loads the compression driver using a DEVICE= statement in CONFIG.SYS.

As for replacing DoubleSpace, Microsoft goes back to the drawing board. If Microsoft wins the appeal and overturns the decision, it could re-release DoubleSpace. Microsoft said it would be interested in providing a new compression engine for DOS, but as yet has no details. Chicago, successor to Windows 3.1, will probably be available by then, and its compression picture is still unclear.—Christopher Barr

Pipeline By Robin Raskin

Why Stay Off the Highway?

Why should productive, well-adjusted humans keep an arm's distance from the Information Highway? Here are some good reasons.

It's too slow. Recently I watched Larry Ellison, CEO of Oracle Corp., demonstrate the wonders of the Oracle Media Server, a multimedia database library that ultimately will serve up movies on demand, home shopping, and video e-mail to homes and businesses everywhere. It's an auspicious project, but for each transaction he made, Ellison went through layers and layers of tedious menu choices delivered by a soft-spoken, patronizing woman named Ms. Menu. One



hour, one movie selection, one pizza purchase, one sweater purchase, and a few video-mail messages later and I was ready to shoot both Ms. Menu and Ellison.

It's a misinformation highway. Message threads remind me of a kid's game of telephone. As the message spreads (and it spreads like wildfire from forum to forum) and readers retell the story, it gets slightly recast and misinterpreted each time. Follow any of the discussions on the hardware forums on subjects such as video conferencing, PCI, or 32-bit OSs, and you'll see what I mean. The democratization of information means that everyone has the right to be an authority.

It's an expensive habit. I know. I sign off on *PC Magazine's* on-line bills, and each time I do I can't help thinking about whether our prose would be better if we e-mailed less and wrote more. While the price of an ISDN installation (about \$40 to \$90 per line

and about twice the cost per minute of a standard telephone line) isn't too bad, you'll find that the headaches come from trying to order the proper service for your equipment. The options are many and arcane; phone companies are not set up to help. And the lawyers haven't had their day in court yet to create the rules for the infrastructure. Once they get involved in the Information Highway, the complexity of offerings will increase tenfold.

On-liners abandon the rules of good behavior. The established rules of behavior in real life are tossed to the wind on-line. Flamers hurl rude, cruel words at each other. Journalists treat on-line words as spoken quotes. Legal minds don't seem to fret over whether on-line agreements are binding. And it's perfectly permissible to be a nuisance. Did you know that after the "E-Mail to Bill" story ran in *The New Yorker*, Microsoft had to write a "bozo filter" to winnow down Bill's junk mail?

It's inefficient. There was a time when I marveled at how directed an on-line search could be. While books hooked you into browsing through aisles and flipping through pages, on-line put you in the driver's seat. With today's proliferation of on-line information, finding what you want is nothing short of a major victory. Eventually, the information highway will sort itself out. Using it efficiently and economically will become second nature. Meanwhile, an eminent scientist and long-time friend of the family once remarked, "If I was ever in close competition with another scientist, and I wanted to get a year ahead, I'd just go out and buy them a computer." True words, but if I really wanted to put them on idle, I'd add an Internet connection to the gift.

Robin Raskin is editor of PC Magazine.

Pixels, Texels, And Sprites

THERE ARE LOTS OF COLORFUL names to describe what you see on a computer screen. You probably know that a pixel is a picture element, and if an image is pixelated that means it's boxy and has jaggies. You may even have heard of the small bitmapped animations called sprites—but do you know what texels are?

In 3-D graphics, shaded polygons are used to render and fill in an underlying wire-frame image, giving it a 3-D look. But it was difficult to create soft textures such as hair, fur, and clouds until texture elements (*texels* for short) were invented. Using an algorithm that makes certain texture mappings more realistic, texels are often used to put hair on humans and fur on animals.

Texels will become better known as 3-D graphics libraries are added to mainstream OSs. OpenGL, the 3-D graphics library



Du Pont Pixel's new Glint chip accelerates 3-D texture mapping.

developed by Silicon Graphics, was licensed by Microsoft and will be in the next version of Windows NT, code-named Daytona. Microsoft said it may put OpenGL into Chicago, the next generation of Windows.

OpenGL comes from the high-end scientific and technical workstation market, and that's probably where it will stay. But Intel is

expected to announce a new 3-D graphics standard that will be used to develop 3-D Windows-based games and animated applications. Sources say a number of video chip makers, including ATI, Chips and Technologies, Matrox, S3, and Weitek, are already developing video accelerators for this new 3-D standard.—Christopher Barr

Desktop PCMCIA: The Next Frontier?

THE PC INDUSTRY HAS FINALLY accepted PCMCIA sockets as the standard way to connect credit card-size modems, network adapters, and storage devices in notebooks. The next frontier for PCMCIA is the desktop, but is there really any need for a PCMCIA socket when you can easily open the box and install an adapter?

Hewlett-Packard and AST seem to think so, and both companies are among the first to put PCMCIA sockets into desktop PCs. Manufacturers can design PCMCIA technology around a drive bay, an adapter card,

or an external device. HP has been experimenting with a \$249 accessory that installs in the front of its Vectra series. The socket accepts two Type II or one Type III card. HP says having a PCMCIA socket on a desktop system is attractive to mobile users who exchange data with their portable systems. HP's OmniBook and 100LX both have PCMCIA sockets.

AST will offer PCMCIA sockets as an option on new desktop systems it will introduce later this year. To accommodate users who want to use the socket for networking and modem cards but want to keep the wires out of the way, AST will offer a PCMCIA socket that users can mount at the rear of the machine; there will be a front-mounted option as well.

Chip makers and software vendors are also showing more interest in PCMCIA technology. Intel recently announced a PCI-based PCMCIA controller that PC manufacturers can install on desktop systems or on adapter cards. The chip will support up to four PCMCIA sockets. And the Plug and Play feature in Chicago (the next generation of Windows) will allow for the insertion, operation, and removal of PCMCIA cards as the machine is running (hot swapping).

Some say it will be a while before PCMCIA is popular on desktop PCs. At a recent conference for computer hardware engineers, Michael Slater, editor of *Microprocessor Report*, said that only a few PC system makers would put PCMCIA sockets on desktop systems in 1994, and that it would become more pervasive in 1995 when Chicago is available.—Christopher Barr

Cars, Light Bulbs, And Power Supplies

WHAT DO CARS, LIGHT BULBS, AND power supplies have in common? They all consume energy, and engineers are endlessly seeking ways to improve their energy efficiency. A year ago, the Environmental Protection Agency's Energy Star program raised the consciousness of the computer community, and manufacturers now design power-saving systems by slowing the CPU's clock, powering down the monitor, and spinning down the hard disk. (See "Power to the PC" in this issue for reviews of PCs that meet Energy Star guidelines.)

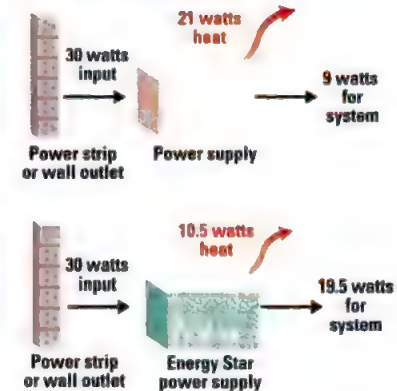
But the power supply itself has remained a challenge. "The power supply has become a focus area for improvement because it's

most efficient at its *rated* load," says Linda Latham, director of the Energy Star program at the EPA. The power supply, which converts alternating current from the wall outlet to direct current, works *less* efficiently as your PC reduces its power consumption. (Efficiency is defined as "power out over power in"; as the "power out" gets lower, the ratio of efficiency gets smaller, too.)

Power-supply makers Astec and PC

Julging Up the Power Supply

Pre-Energy Star power supplies are 30 percent efficient. Redesigned power supplies are 65 percent efficient.



Source: Astec

Power and Cooling have developed techniques to improve efficiency. "Prior to the EPA's Energy Star program, we were getting 30 to 35 percent efficiency at Energy Star loads," says Jim Bolit, vice president of marketing/engineering at Astec. He compares the loss to that of an incandescent lightbulb, which is only 20 percent efficient; most of its energy is heat, only a small amount is actually light. "We needed to make efficiency at light loads a goal, so we turned our engineering staff on it. We got to 65 to 70 percent by identifying all the inefficiencies in the circuitry and making design improvements," says Bolit. Astec redesigned the main power converter and control loop and now uses *lower loss* (that is, more efficient) components.

For the future, engineers are looking to drive the percentages even higher by implementing better power-conversion schemes. In the 1970s, the automobile industry was faced with improving the efficiency of the engine combined with reducing the emissions, explains Bolit. "You now get 30 miles per gallon and better performance instead of 15 miles per gallon because of the fundamental changes to the power-conversion schemes."

Cost—an extra \$10 or so—remains the barrier to getting new, improved power supplies in every PC.—Carol Levin

Top Retail Software		
Current ranking	Last Issue	Product/company
1	1	MS-DOS 6.2 Upgrade Microsoft Corp.
2	—	Quicken 7 for DOS Intuit
3	10	OS/2 for Windows IBM Personal Software Products
4	11	Quicken 3 for Windows Intuit
5	—	Stacker 4.0 Stac Electronics
6	14	QEMM 7.0 Quarterdeck Office Systems
7	5	MS Windows 3.1 Microsoft Corp.
8	—	WordPerfect 6.0 for Windows WordPerfect Corp.
9	—	TurboTax Final 1040 11.1 for DOS Intuit
10	9	MS Office 4.0 for Windows Upgrade Microsoft Corp.
11	—	CompuServe Membership Kit CompuServe
12	—	Lotus 1-2-3, Release 4.01 for Windows Upgrade Lotus Development Corp.
13	—	MS Works 3.0 for Windows Upgrade Microsoft Corp.
14	—	Procomm Plus for Windows 1.02 DataStorm Technologies
15	—	Andrew Tobias's TaxCut Final Edition MECA Software

This list ranks PC business programs according to the total number of copies shipped to stores and resellers in the week ending February 19, 1994. The list is based on shipments to more than 12,000 retail locations. It does not include sales made directly by software publishers and can not be interpreted as a picture of the entire software market. Sales information adapted from a compilation by Ingram Micro.

Targeting the Electronic Consumer

E-Books Find Their Identity

WHEN WAS THE LAST TIME YOU read an electronic book? Chances are you've tried it and have no compelling desire to try again. If ever there was a technology struggling to find a purpose, it's the e-book. Recently, though, several small, innovative companies with software development experience have emerged as the front-runners in a new genre that may finally give you a good reason to turn on an e-book.

The first stabs at e-book development were underwhelming; repackaging a text in electronic format had few advantages over its printed counterpart. Now, however, hybrid e-books are finding more success.

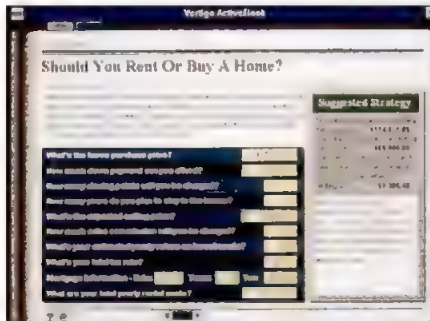
It all started with Design and Build Your Deck, (\$59.95) from Palo Alto, California-based Books That Work. This hands-on guide shows you how to design a deck, cost it out, write a shopping list, and build it. Home Repair, also from Books That Work, followed. Then in mid-February, media giant Hearst Corp. bought a 10 percent stake in the small developer and announced plans to launch a series of e-books for consumers.

Another startup that's taking e-books in the consumer direction is Vertigo Development Group in Cambridge, Massachusetts, a company formed by a group of software developers and entrepreneurs from Lotus. Vertigo developers are applying their software R & D knowledge to create "ActiveBooks" that fill a gap in today's software applications, says Vertigo's Paul Stroube.

Vertigo teamed up with Dow Jones, which supplied a series of recent articles from *The Wall Street Journal* that explain basic financial strategies. Vertigo developers then wrapped this content around a "spreadsheet object" and put everything inside a Windows interface. With *The Wall Street Journal Personal Finance Library* (\$49.94; also bundled with the CD-ROM version of Quicken), you can brush up on sound financial strategies, then click on an "Active Information" icon to launch a mini-application that calculates how to plan for retirement or finance a new home, based on information you provide.

Positioned to capitalize on the boom in home computing (nearly one-third of American homes now have computers), both Vertigo and Hearst have ambitious plans. Vertigo is collaborating with *USA Today* on *The Parent's Guide to Money* and hopes to

team up with *Money* magazine as well. And Hearst is planning to publish e-books on home decorating and entertaining, gardening, and other consumer pastimes that dovetail with its *Good Housekeeping*, *House Beautiful*, and *Popular Mechanics* magazines. —Carol Levin



Vertigo's ActiveBooks focus on personal finance.

Reshaping On-Line Services

PRODIGY AND AMERICA ONLINE are successful today, but if they don't keep evolving rapidly, they'll look primitive next to some of the new consumer-oriented on-line services we'll be seeing in the next year.

What's On-Line in 1994

Company	On-line service	Start date	Focus
Apple	e•World (for Windows)	Fall 1994	News shopping e-mail, references
AT&T	PersonaLink	July 1994	eShop, e-mail, travel
Hearst	HomeNet	Winter 1994	Consumer resource tied to <i>Good Housekeeping</i> , <i>House Beautiful</i> , and <i>Popular Mechanics</i>
IBM Japan	People	July 1994	E-mail, news, restaurants, entertainment, Internet access
Infonautics	Homework Helper	September 1994	academic references literature, Monarch notes, current news
Watermark Systems	Interactive Jobs Network	February 1994	National employment search service, resume forwarding
Ziff-Davis Interactive	Interchange (working name)	Fall 1994	Forums and extensive resources for computer users, news, references, e-mail, Internet access

Hearst's New Media & Technology Group, headed by former Federal Communications Commission chairman Alfred Sikes, hopes to cultivate the consumer market—and leverage Hearst's enormous magazine readership—by launching HomeNet. Promising much more than electronic recipes and on-line articles, HomeNet may be hosted by an on-line service provider and



eShop brings the shopping mall to you.

will include interior design, home renovation, gardening, cooking, and entertaining services. "Our vision is to have a video-rich product, but that can only work as fast as the underlying technology allows us to," says Sikes.

While parents log on to learn about deck-building, the K-12 set can turn to Homework Helper, an on-line reference library developed by Infonautics of Wayne, Pennsylvania. Scholars of all ages can ask questions in plain English—"What's Newton's second law?" or "Tell me about symbolism in *The Grapes of Wrath*"—and Homework Helper will search its vast database and display full-text references. First available over Prodigy and later the Internet, Homework Helper's sources include Compton's Multimedia Encyclopedia, the World Almanac, 35 news publications, maps, over 700 literary works, and CNN's broadcast transcripts.

Graduates ready for the real world can post their employment profiles on the Interactive Job Network (800-323-3282). The network's search engine will match that profile with its own database of nationwide job postings. It also offers resume forwarding.

In addition to the latest U.S. announcements of services like Apple Computer's e•World, AT&T's PersonaLink, and Ziff-Davis Interactive's Interchange, there's also a flurry of on-line activity abroad. In July, IBM Japan will start People, a Japanese-language on-line service that will offer leading Japanese newspapers and magazines, sports and entertainment information,

e-mail, and Internet access, all within a graphical interface. And CompuServe has been increasing the number of local nodes at international locations in order to provide local-language services and regional information. So on a future trip to Paris you'll be able to consult CompuServe for the scoop on local restaurants and entertainment. —Melissa J. Perenson

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ZEOS dual scan screen (left) fires up rich, vibrant colors while standard passive matrix screen (right) produces faded and dull colors. Photos are not retouched.

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- Lotus Organizer

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ColorNote 486: \$2695

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- Custom nylon carrying case
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- Microsoft Windows for Workgroups 3.11
- Lotus Organizer

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CIRCLE 036 ON READER SERVICE CARD

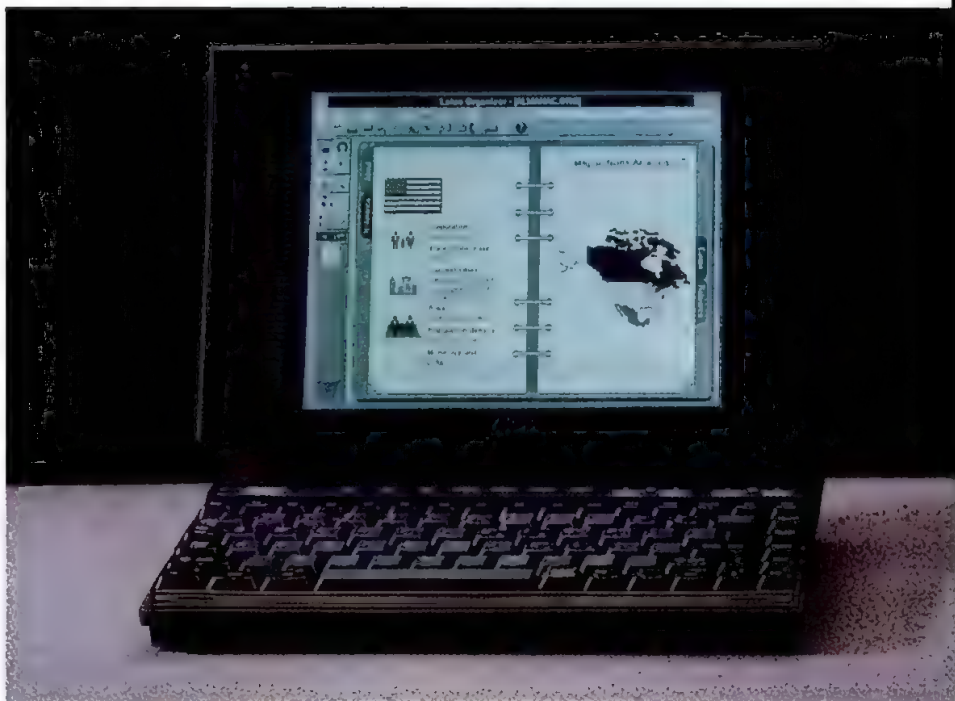
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- Serial, parallel, video and PS/2 (for keyboard, mouse or 10-key pad) ports.
- 486SL includes 3.3V technology for added battery life, and a built-in math coprocessor.
- Replaceable and rechargeable NiCad battery.
- 81-key keyboard with built-in mouse key, "inverted T" cursor keys and dedicated Home, PgUp, PgDn, and End keys.
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486SL-25: \$1495

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486SL-33: \$1695

Lease \$61/month

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- 80MB IDE hard drive (386SL); 120MB IDE hard drive (486SL)
- MS-DOS 6.2

PACKAGE 2

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Lease \$63/month

486SL-25: \$1795

Lease \$65/month

486SL-33: \$1995

Lease \$72/month

- 6MB RAM (386SL); 4MB RAM (486SL)
- 120MB IDE hard drive (386SL); 180MB IDE hard drive (486SL)
- Custom nylon carrying case
- MS-DOS 6.2
- Microsoft Windows for Workgroups 3.11

PACKAGE 3

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Lease \$72/month

486SL-25: \$2195

Lease \$79/month

486SL-33: \$2395

Lease \$87/month

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PACKAGE 2

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486SL Contenda: \$1695

Lease \$61/month

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- 80MB IDE hard drive
- External 3.5" floppy drive
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486SL Contenda: \$1995

Lease \$72/month

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- External 3.5" floppy drive
- Custom nylon carrying case
- Extra battery
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- MS-DOS 6.2, Windows for Workgroups 3.11, Lotus Organizer

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March 1994, PC COMPUTING

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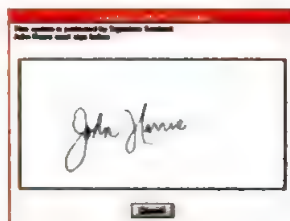
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First Looks

HANDS-ON REVIEWS OF NEW SHIPPING PRODUCTS

■ Another Week, Another CPU

Intel's 90- and 100-MHz Pentiums Define The New High End

BY TIN ALBANO

You are just starting to understand how the advent of Intel's 100-MHz DX4 CPU could change PC pricing through the rest of the year, and now along come two more Intel processor breakthroughs—the 90- and 100-MHz Pentiums—that are sure to put even more downward pressure on the prices of

PCs built around their slower predecessors.

Hurriedly announced on the same day as the 100-MHz DX4, in part to steal some of the thunder of Apple's PowerPC-based Macintosh announcements (see the First Looks review in this issue), the 90- and 100-MHz Pentiums not only define a new high end that will make mid-level PCs more powerful and

POWERSTATION:
Micron's system packs a 90-MHz punch.

less costly as a result but also threaten the very existence of the 60- and 66-MHz Pentium chips. Suddenly, those CPUs seem to hold a less compelling

spot on the price/performance curve.

The new 90-MHz chip isn't just a souped-up version of the 60- or 66-MHz Pentium but an entirely redesigned processor. The chip offers not only increased performance but also more economical power usage. Unlike its slower and more power-hungry siblings, which need 5 volts to operate, the 90-MHz Pentium operates at a cool 3.3 volts.

Systems with 100-MHz Pentiums are expected to be fairly widely available by June. The first 90-MHz Pentium-based systems PC Labs received for evaluation were Micron Computer's \$4,819 P90PCI Powerstation and

Continues on page 38

■ Apple Embraces Next-Generation Processor

PowerPC Chip Helps New Macs Match Top PC

BY JOHN CLYMAN

Just weeks after Apple Computer celebrated the tenth anniversary of its revolutionary Macintosh, the company has begun shipping a new breed of Macs based on the PowerPC RISC processor family that Apple developed along with IBM and Motorola. (For more information about PowerPC processors, see "PowerPC: Your Next CPU?" and "A Look Inside the PowerPC 601," February 22, 1994.)

The new Macs provide an impressive first glimpse of PowerPC's capabilities, although their full potential will remain latent until PowerPC-specific software becomes widely available.



7100/88: A Mac for the mainstream.

Apple's three new models, all based on the PowerPC 601 processor, are everything we expected: fast and compatible, if moderately high-priced. The Power Macintosh 6100/60 is a

60-MHz entry-level machine in a thin-profile pizza-box case with minimal expandability. (Only one 7-inch NuBus slot is provided.) A \$2,209 base configuration includes 8MB of RAM, a 160MB hard disk, VGA-quality video circuitry and monitor, and a basic keyboard.

The 66-MHz Power Macintosh 7100/66, the system Apple is targeting at mainstream business users, comes in a Quadra 840-style case with three full-size NuBus expansion slots. With 8MB of RAM, a 250MB hard disk, local-bus video with 1MB of VRAM (upgradable to 2MB), a monitor, and an enhanced keyboard, the unit sells for \$3,659.

At the top of the line sits Apple's 80-MHz Power Macintosh 8100/80, which is priced at

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First Looks

90-MHz Pentium

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ZEOS International's \$4,044 Pantera-90.

DRESSED TO THE NINES

Without the proper complement of components, a PC's overall performance will suffer regardless of the speed of its processor. Micron and Zeos both understand that people willing to invest in PCs with the fastest CPUs want lots of memory, large hard disks, and superior video performance. So, each company sent evaluation units to PC Labs that were fully loaded.

The Micron PowerStation's standard footprint chassis has four ISA, two PCI, and one ISA/PCI expansion slot. The PowerStation came packed with 32MB of RAM (expandable to 128MB), a 540MB IDE hard disk, a 512K cache, a Mitsumi double-speed CD-ROM drive, a Matrox MGA PCI video card, a 15-inch SVGA monitor, and a solid helping of software.

Zeos sent its Pantera-90 with 16MB of RAM (expandable to 192MB), a 540MB IDE hard disk, a 512K cache, a Mitsumi double-speed CD-ROM drive, a Diamond Viper PCI video card, a 15-inch SVGA monitor, on-board business audio, and software. This roomy tower unit has ten available drive bays and seven expansion slots (two PCI, four ISA, one PCI/ISA).

PCI ARCHITECTURES

Both the PowerStation and the Pantera-90 have PCI-bus architectures that operate at 60 MHz.

The new Pentium processor has an internal clock speed of 90 MHz, and, with its programmable clock generator, the chip can handle internal/external frequency ratios of 2:1, 1.5:1, or 1:1. This allows the 90-MHz Pentium to communicate exter-

nally with buses that run at 50- or 60-MHz.

In benchmark testing, we had expected to see significant performance increases on our PC Bench Processor test because of the new Pentium's faster clock speed. The PowerStation and the Pantera-90 didn't disappoint, turning in processor performance scores—101.65 and 102.17, respectively—that were exactly what we had anticipated.

Compared with average processor performance results for slower CPUs, both the PowerStation and the Pantera-90 triple the performance of 50-MHz 486DX2s and more than double that of 66-MHz 486DX2s. The 90-MHz Pentium-equipped systems also handily beat out the average processor performance scores of 60- and 66-MHz Pentiums (69.45 and 78.18, respectively).

The two 100-MHz DX4 systems we tested in the last issue (First Looks, April 12, 1994), the Micron 4100PCI Magnum and HP Vectra VL2 4/100, were certainly impressive when com-

pared with buses that run at 50- or 60-MHz.

NOT PROCESSORS ALONE

Since a PC is a union of many different parts, more processor muscle doesn't necessarily mean higher system performance across the board.

Although both the PowerStation and the Pantera-90 turned in scores on the Winstone 94, Graphics WinMark, Disk WinMark, and disk tests that surpassed those of earlier Pentiums, the DOS video and DOSmark scores clearly show that sheer processor power isn't everything.

The Micron system outscored the Zeos system on both the Graphics WinMark and Winstone 94 tests, but the Zeos machine had higher DOS video and DOSmark scores than the Micron. This turning of the



PANTERA-90: The top processor score.

DOS-intensive tests. The Pantera's Diamond PCI Viper video board, on the other hand, has historically turned in good Graphics WinMark and Winstone scores while managing to maintain decent results on DOS tests.

CHIP OF A NEW GENERATION

Both the Micron P90PCI PowerStation and ZEOS Pantera-90 met all our expectations, and if you're already in the market for a 90-MHz Pentium PC, either one of these systems will deliver the performance that Intel claims for its new CPU. Their prices, too, are in the comfort zone. Machrone's Law, first formulated in these pages by Bill Machrone ten years ago, is still true today: The PC you want *always* costs \$4,000.

• List price: Micron P90PCI PowerStation, \$4,819. Micron Computer Inc., 915 E. Karcher Rd., Nampa, ID 83687; 800-347-3490, 208-465-3434; fax, 208-465-3424.

Circle 430 on reader service card.

• List price: ZEOS Pantera-90, \$4,044. ZEOS International Inc., 1301 Industrial Blvd., Minneapolis, MN 55413; 800-423-5891, 612-633-4591; fax, 612-633-1325.

Circle 431 on reader service card.

Benchmark Tests: 90-MHz Pentium Systems

The processor scores for the ZEOS Pantera-90 and Micron P90PCI PowerStation show that Intel's 90-MHz Pentium processor is the most powerful chip we've seen to date. Note both systems' outstanding Graphics WinMark and Winstone scores, which show how well

equipped these units are for high-powered GUI-based computing.

We used PC Magazine Labs' PC Bench 8.0; WinBench 4.0; and Winstone 94, Version 1.0, to measure the performance of these 90-MHz Pentium systems

	PC Bench 8.0				WinBench 4.0		Winstone 94
	Processor (score)	Video (score)	Disk (score)	DOSmark (score)	Graphics WinMark (millions of pixels per second)	Disk WinMark (score)	Winstone (score)
ZEOS Pantera-90 (Pentium/90)	102.2	1,516	1,640	966	22.2	2,590	95.1
Micron P90PCI PowerStation (Pentium/90)	101.7	563	1,530	581	30.9	3,070	112.7
Pentium/66 average	78.2	1,825	1,414	834	20.7	1,393	83.0
Pentium/60 average	69.5	2,279	1,392	828	18.2	1,218	73.3
Micron PCI 4100 (DX4/100)	64.0	1,538	1,378	754	20.2	1,218	81.7
HP Vectra VL2 4/100 (DX4/100)	62.4	5,275	1,338	918	12.4	2,060	31.2
486DX2/66 average	39.7	3,359	1,050	593	9.5	861	49.7
486DX2/50 average	31.9	3,116	974	502	8.3	761	40.0

pared with the systems using the older Pentium CPUs, but the Magnum and Vectra's processor scores (64.05 and 62.36, respectively) seem mediocre when stacked up against the PowerStation and Pantera's scores. That's because the DX4

tables is due to the two PCs' video subsystems.

The PowerStation was outfitted with a Matrox MGA PCI video card, which we have found produces excellent numbers on tests that stress Windows usage but lags behind on

PowerPC Mac

CONTINUED FROM PAGE 37

\$4,869 for a similar configuration with double the VRAM (expandable to 4MB) and a 256K external processor cache.

All three models are available in optional configurations that include an internal double-speed CD-ROM drive, larger hard disks, and more RAM (each unit supports a maximum of 136MB of RAM). The 256K L2 cache that is standard on the 80-MHz model is a \$299 option on the other models. All three models are also offered in an "AV" configuration, which, like that for the current Quadra AV machines, includes NTSC-compatible video input and output.

A fully-loaded Power Macintosh 8100/80 CDAV, which includes 16MB of RAM, a 500MB hard disk, and the CD and AV options, will cost you just over \$6,000 with a monitor and keyboard. All of these prices are "Apple prices"; not list prices but estimates of what Apple dealers will actually charge. The Power Macintoshes may be more expensive than many Pentium systems, but they do come standard with features that would raise the cost of most PCs: 16-bit sound, integrated SCSI, and built-in Ethernet support.

SOFTWARE SUPPORT

The Power Macintoshes run System 7.1.2, a version of System 7 specially modified to run on the PowerPC. PowerPC processors cannot run existing 680x0-based Mac software unassisted, but Apple has configured System 7.1.2 and the Power Macintoshes' ROM to provide completely transparent emulation capabilities for nearly all existing software. As a result, the new systems behave exactly like any other Macintosh; the only giveaway that a RISC processor is inside is a jazzy new

startup sound.

Most existing system extensions and control panels (INITs and CDEVs) will run without modification on the Power Macintoshes. And according to Apple, the only applications known to be incompatible with the Power Macintoshes are those that use obsolete 24-bit address-



8100/60: An entry-level PowerPC.

ing modes and those few that bypass the Standard Apple Numerics Environment in an attempt to control directly the 68881 chip (the 680x0 math coprocessor). Most existing add-on hardware should function properly in the new machines. Apple, however, reports that some high-performance expansion cards will require new device drivers to work properly.

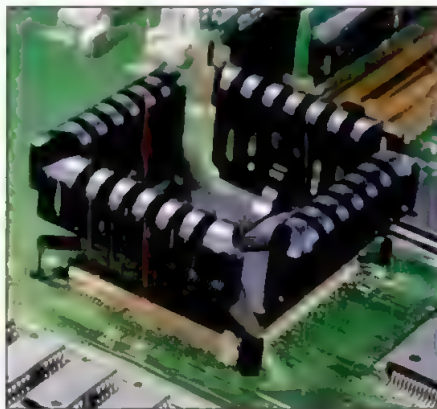
With the help of Insignia Solutions' SoftWindows emulator, which is bundled in some configurations and also available separately for \$499, Power Macintosh systems will even be able to run most DOS and Windows software. PowerPC's horsepower is sufficient to make typical apps run at a tolerable speed—about that of a midrange 386 system, according to our tests. While that kind of performance won't induce you to give up your PC, it's adequate for running the occasional left-over application, should you decide to buy a Mac for other reasons.

COMPETITIVE PERFORMANCE

Although the Power Macintoshes will run existing Macintosh software, they do so at a slight performance penalty. We found that, in most cases, the PowerMacs ran 680x0 programs at about the speed of a Quadra 840AV or a Quadra 950.

That means Power Macintosh adopters won't see a dramatic benefit from PowerPC until they upgrade their software to versions recompiled specifically for the processor. On April 14, when Apple announced the Power Macintosh line, 150 software developers had pledged support for PowerPC, but only a handful were actually shipping native software. Moving to native software shouldn't be an overwhelming financial burden for users. Many developers are offering cross-upgrades for nominal fees, and Adobe Systems has even made a number of its Photoshop special-effects filters available for free downloading.

Our preliminary testing of prerelease PowerPC software showed impressive performance



THE POWERPC: Pentium-like power.

gains. The PowerMacs proved roughly as fast as Pentium systems at the same clock speeds, and about twice as fast as high-end Quadras. The PowerMacs' floating-point performance was particularly impressive, thanks to the highly optimized FPU

present on every PowerPC chip.

PowerPC's primary appeal is its performance, which at last brings Apple a measure of parity with PC compatibles, but there are plenty of other notable features to try out. One is Apple's PlainTalk, which provides passable voice-command and text-to-speech capabilities (standard on the AV-equipped machines, available with the addition of an AV-compatible microphone on other systems). The Power Macintoshes can also emulate a 9,600-bits-per-second modem on the CPU; a low-cost add-on "pod" with a digital-to-analog converter is all you need to give the Mac this capability.

FUTURE DIRECTIONS

The three recently-announced Power Macintosh models are just the first members of Apple's PowerPC-based product line. Expect more Power Macintosh models—including some that use the PCI (Peripheral Component Interconnect) bus in place of the company's proprietary NuBus—later this year.

A PowerPC-based portable computer won't be available from Apple until early 1995, after the low-power PowerPC 603 chip has begun shipping in quantity.

Power Macintosh systems based on the PowerPC 604 processor, which by early estimates will run at about three times the speed of the PowerPC 601, should also be available some time next year. That kind of power may be what Apple needs to ensure planned enhancements to the Macintosh user interface, including features such as support for three-dimensional graphics and "agents" that automate frequently performed tasks.

• List price: Power Macintosh 6100/60, \$2,209; Power Macintosh 7100/66, \$3,659; Power Macintosh 8100/80, \$4,869. Apple Computer Inc., 20525 Mariani Ave., Cupertino, CA 95014; 800-776-2333, 408-996-1010; fax, 408-996-0275.

Circle 429 on reader service card

Databases

InfoModeler: Database Design In Plain English

BY SAL RICCIARDI

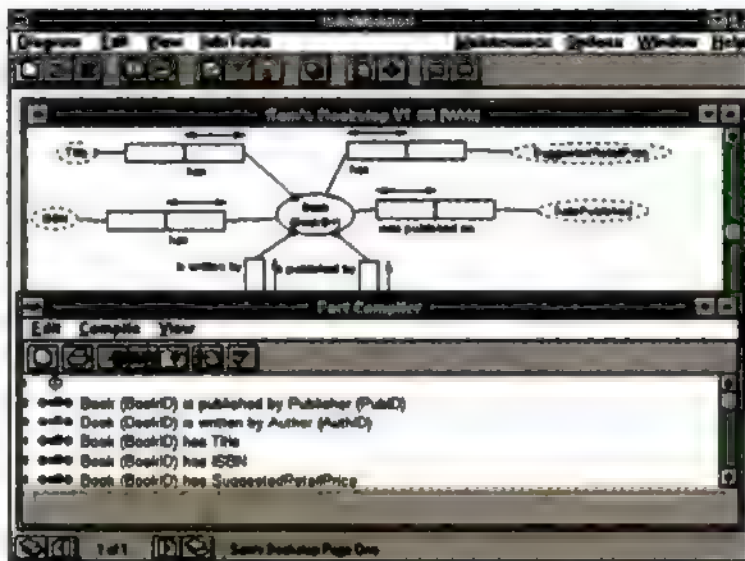
The first release of InfoModeler, a new data-modeling tool from Asymetrix Corp., gives database designers plenty of reasons to get excited. The \$795 program lets you use simple English facts to describe the world that you're modeling. This helps break down the terminology barriers that sometimes exist between the database designer and the database user. The InfoModeler program works with Access 1.0 or 1.1, FoxPro 2.5 for Windows, Paradox 1.0 for Windows, Oracle7, and Microsoft/Sybase SQL Server 4.2.

Once you enter your facts, you simply press a button to generate complete logical and physical designs with the appropriate database structures. Because InfoModeler automatically generates the design, you can spend more time concentrating on accurately representing business facts and less time worrying about tables and columns.

ALL THE WAY THROUGH

InfoModeler can take you from the information-gathering stage of database design all the way to generating the physical tables required for your database. To design a database, you first gather samples of all the information you need to store; for instance, by examining forms and reports. Then you build a conceptual model of the database by describing the information you've gathered as elementary facts

using ordinary English. For example, for a book database you might describe one elementary fact as "Book is written by Author". For an employee data-



TWO METHODS: InfoModeler lets you create and enter facts using either the Fact Compiler or the Fact Diagrammer.

base, an example might be "Employee works for Company".

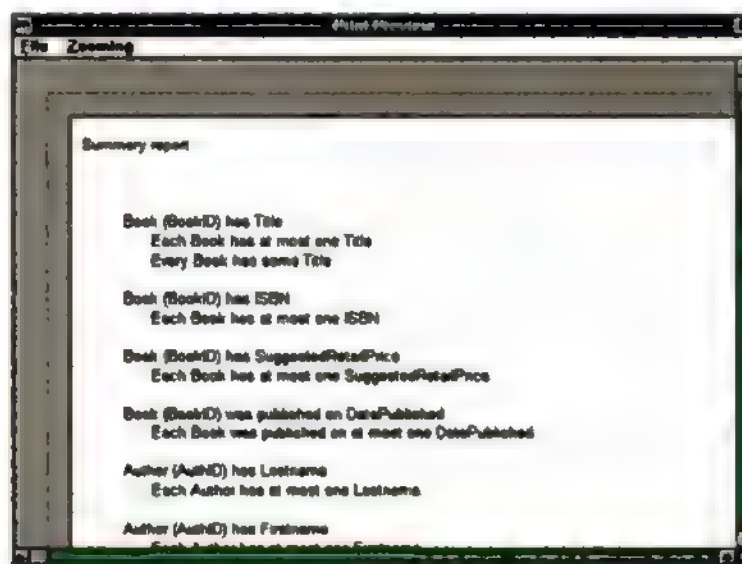
InfoModeler uses a data modeling methodology called Formal Object Role Modeling Language (FORML). Here, each elementary fact consists of objects and the roles they play in the world you're modeling. For example, "Employee" is an object and "works for" is a role.

Once you've entered all of your elementary facts, you can then add constraints to describe integrity rules. For example, the statement "Every Book is written by some Author" represents a mandatory role constraint, meaning that each book must have an author. The statement "Each Employee works for at most one Company" is an internal uniqueness constraint,

meaning an employee can work only for one company. InfoModeler supports 14 different constraint types.

You create the conceptual model in one of two ways: by entering English facts into InfoModeler's Fact Compiler, or by diagramming the facts using the Fact Diagrammer. The Fact Compiler is where you enter complete facts in English using the rules of FORML. The Fact Diagrammer is where you create and link graphic symbols that in combination represent each complete fact.

The two tools work together. For example, facts compiled in the Fact Compiler generate the corresponding graphics symbols in the Fact Diagrammer. Similarly, facts constructed in the Diagrammer Window can be decompiled, in which case the corresponding FORML facts are generated in the Fact Compiler window. You can use



SUMMING IT UP: InfoModeler's Summary report includes an easy to understand description of each fact in the database.

either tool or both, or switch between them as you wish.

AUTOMATIC GENERATION

Once you've entered all of your facts, you press a button and InfoModeler validates your conceptual model and then gener-

ates a complete normalized logical database design. You can use the Table Browser to view the results and make adjustments. You can then take the final step and generate code to create the actual physical database structures.

InfoModeler stores information in a repository and can produce a series of useful reports that document your data model. Because the facts are described in natural language, the reports can be readily understood by clients and end users.

The first release of InfoModeler has a few flaws. There are some constraints that can't be entered in the Fact Compiler, only in the Fact Diagrammer. The Diagrammer lacks any of the most modern drawing conveniences, such as alignment controls and the ability to select and move multiple objects at once. And the Fact Compiler displays some occasional quirks, rejecting what seems to be acceptable FORML text. That's not much of a problem, though; you can sidestep it simply by working in the Diagrammer.

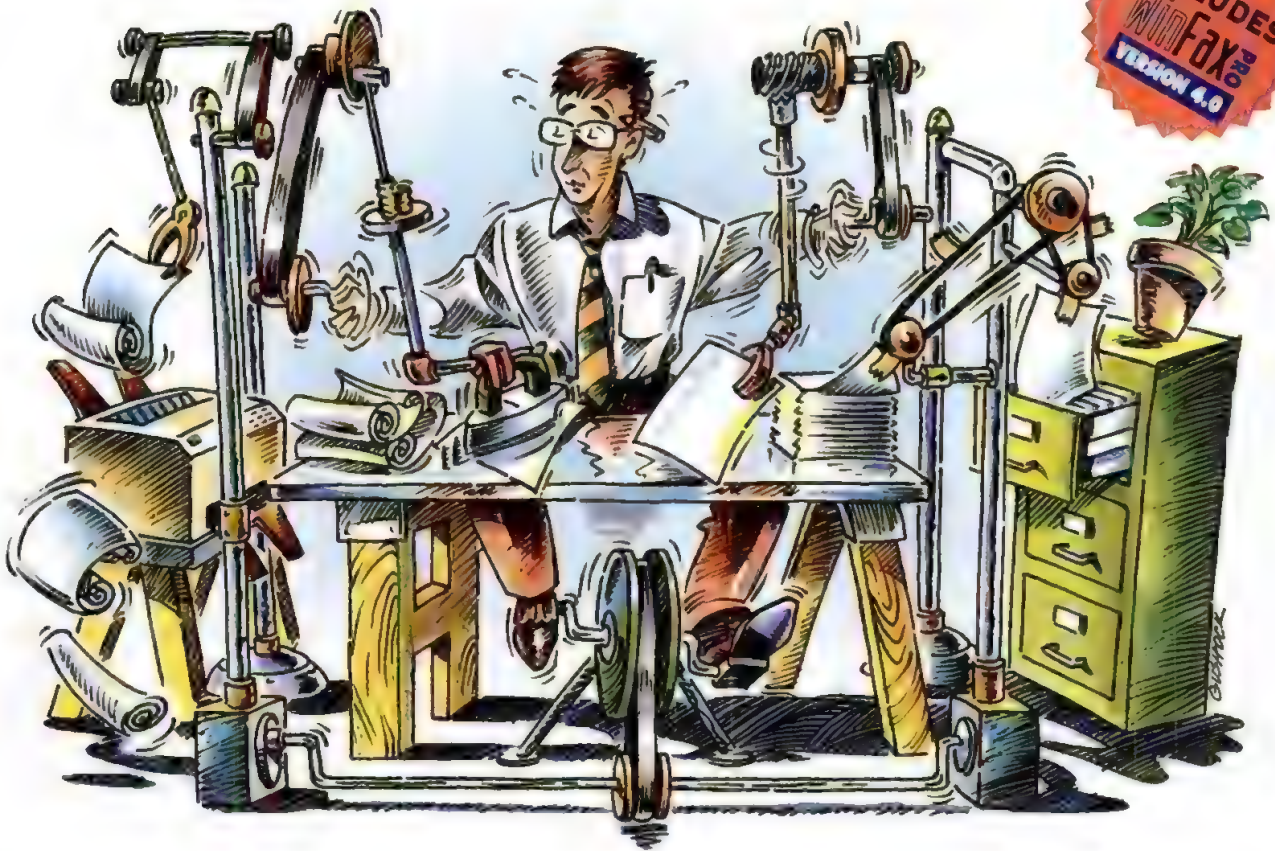
All things considered, InfoModeler is a really useful tool that will speed up the work of many database designers. By focusing your attention on describing facts instead of on relational design details, InfoModeler helps you produce designs that are more accurate and complete. Because of its use of natural language, it facilitates communication between technical designers and nontechnical end users. If you're designing databases, you owe it to yourself to give InfoModeler a try.

- List price: *InfoModeler, Version 1.0*, for desktop systems (Access, FoxPro, Paradox), \$795; for Oracle7 systems, \$1,495; for Microsoft/Sybase SQL server systems, \$1,495. Requires: 8MB RAM, 10MB hard disk space, Microsoft Windows 3.1. Asymetrix Corp., 110-110th Ave. NE, #700, Bellevue, WA 98004; 800-448-6543, 206-462-0501; fax, 206-637-1504.

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For Your Information.

CIRCLE 292 ON READER SERVICE CARD

Optical Character Recognition

OmniPage Pro: New Speed, New Text Recognition

BY LORI GRUNIN

While the jump from 2.1 to 5.0 may be extreme, Caere Corp.'s \$695 OmniPage Professional 5.0 boasts increased optical character recognition (OCR) accuracy across a broad range of documents, as well as a new interface that's finally worthy of the product behind it.

Since most good OCR packages, including OmniPage, have a character recognition success rate of over 97 percent on clean documents, it is almost impossible to quantify the improvement in OmniPage 5.0's accuracy without going through thousands of scans. We can say, however, that on a variety of documents (ranging in difficulty from simple text-only pages to faxed

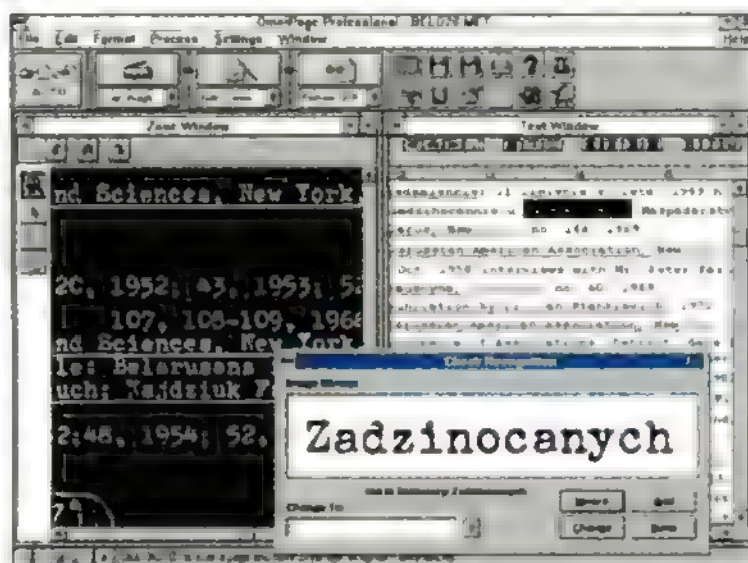
copies of spec sheets, magazine and newspaper clippings, an alphanumeric table of 7-point type, and old scribbled-on, faded, typed pages), OmniPage had little trouble turning scanned images into data. At worst, the output still proved to be more efficient than re-keying the entire document.

While the program supports Hewlett-Packard's AccuPage 2.0, its 3D OCR and AnyPage algorithms simulate AccuPage's two key features on any scanner. The new 3D OCR feature scans a page as 4-bit gray scales instead of black and white; this provides the program with extra information that helps it filter out noise and rebuild fragmented characters. The older AnyPage technology dynamically

adjusts brightness and contrast at various locations across the page to improve the program's ability to separate characters from the background.

SPEEDY RECOGNITION

Recognition takes place at a pretty speedy clip as well. We processed a messy six-page pre-scanned file, set OmniPage for automatic save to ASCII, and turned on most of its recognition-enhancing algorithms. The program handled about 1.7 pages per minute, or 434 words per minute. 3D OCR and AnyPage do add a bit of overhead, however. For instance, a page scanned with both enabled took 80 seconds from scan to text, while a page scanned with both disabled took only 45.



CHECK MATE: *OmniPage Pro provides visual aid when verifying text.*

A bottleneck occurs when data is transferred from the scanner to OmniPage, which makes sense since the scanner transfers far more data. (We tested OmniPage Pro on a 66-MHz 486 with a Microtek ScanMaker IIG scanner, 28MB of RAM, and a 5MB swapfile.)

An improved text editor that supports character and paragraph formatting has a spell-checker and includes a new WordScan-like tool for popping

up a bitmap of the original during the manual text verification process, making it exceptionally easy to proof and correct the



TRUE TO FORM: *OmniPage Pro's True Page preserves document layout.*

recognized text.

On the output side, OmniPage Pro is the first product to offer the option of preserving the layout of a page—including embedded graphics—in addition to the font and paragraph formatting. This feature, called True Page, places each algorithmically defined block into a separate frame when it saves to Ami Pro, Microsoft Word for Windows, or WordPerfect formats.

NEW INTERFACE

OmniPage Pro now has a clean, iconic interface that puts all the important functions up front. You can automatically go from scan to text with the click of a button. Other features to note include support for MAPI-based e-mail systems, Twain, and 11 Latin-based languages (in addition to English).

All was not smooth sailing with OmniPage. The program initially refused to function properly with the ScanMaker IIG, a problem that Caere tech support could not address. Later, we found that deleting two files in the OmniPage directory

solved the problem. We then experienced an inexplicable memory-related crash because of conflicts with our graphics adapter driver (ATI Mach32 driver, Version 2.21). Switching to a generic Windows driver solved this problem.

True Page is useful for creating WYSIWYG copies of pages that you can retrieve via full-text searches, but its propensity to place each paragraph in a separate frame does tend to produce unwieldy documents with slightly misaligned layouts. It could use more intelligence.

Nor does the OmniPage program handle even slightly skewed input very well, which makes scanning of bound documents fairly difficult. Similarly,

while the MasterSoft filters that Caere uses for exporting to the different text and data formats do a creditable job, we are still seeing some of the same old glitches, such as improperly columnized spreadsheets.

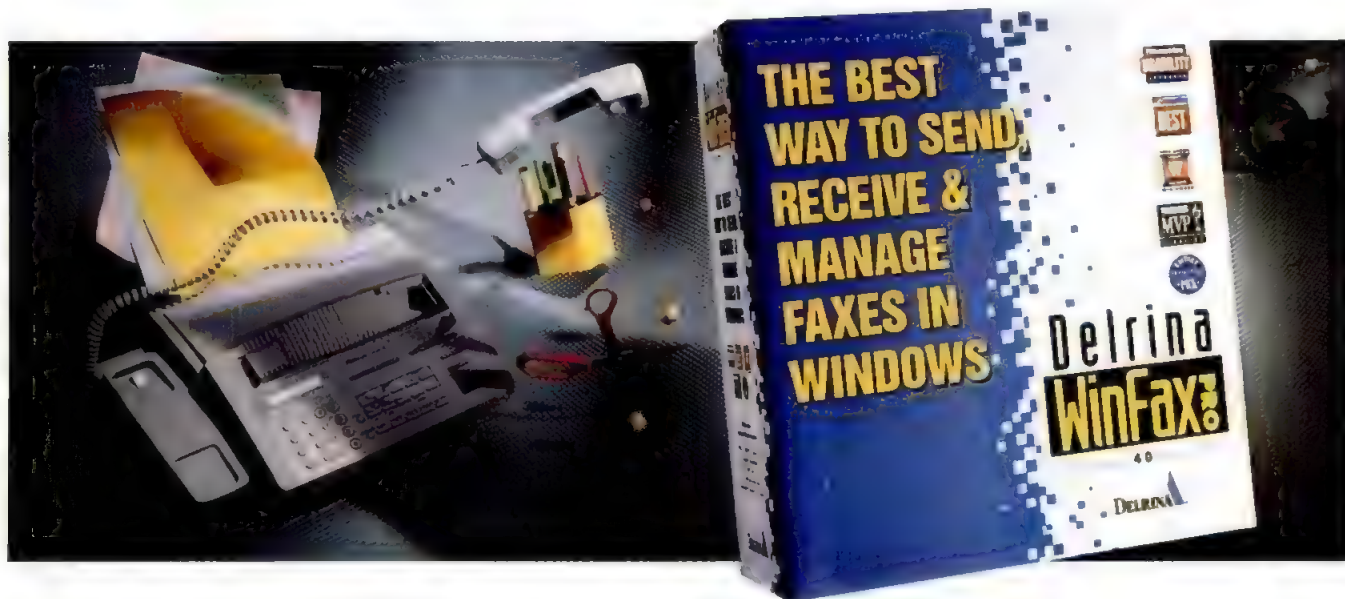
If \$695 (or the approximately \$500 street price) busts your wallet, a less costly version, the \$495 OmniPage (street price around \$330), provides the same basic product without 3D OCR, True Page, and some of the custom recognition tools.

If you thought that OCR stood for only occasional character recognition, OmniPage Professional 5.0 will change your mind. Current users will find it the upgrade worthwhile, and anyone who needs to scan fairly straightforward documents will not be disappointed.

• **List Price:** *OmniPage Professional 5.0, \$695; upgrade from Version 2.1, \$129. Requires: 8MB of RAM, 22MB hard disk space, Microsoft Windows 3.1. Caere Corp., 100 Cooper Ct., Los Gatos, CA 95030; 800-535-SCAN, 408-395-7000; fax, 408-354-2743.*

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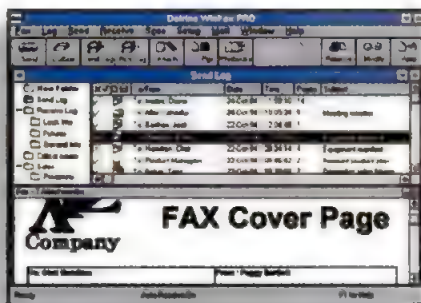
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CIRCLE 250 ON READER SERVICE CARD

■ Color Printers

\$9,995 Tektronix Phaser 300i Is Best for Graphic Artists

BY ALFRED POOR

The new Tektronix Phaser 300i is similar to the Phaser III PXi, which was an Editors' Choice 16 months ago ("Color PostScript: Edging Toward the Mainstream," November 24, 1992). This \$9,995 color printer has many attractive features, but the market has changed so much in the past two years that it may have some trouble competing.

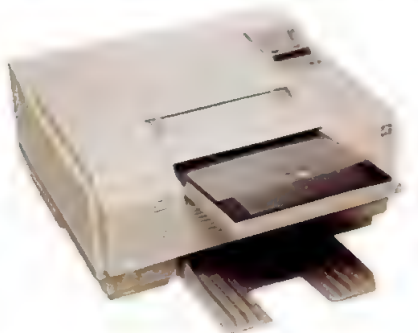
The 300i uses the same 300-dpi, phase-change ink jet technology as the III PXi, and the fact that it lets you use almost any type of paper or transparency for your output is a big benefit. The printer melts crayonlike wax blocks and then sprays the wax onto the page using 31 jets per color. Tektronix estimates the cost at about 30 cents per page, making the 300i an attractive alternative to color photocopies.

MAKE ROOM

This printer is no shrinking violet; it is more than 2 feet wide and 2 feet deep and more than a foot high, and it tips the scales at about 90 pounds. You'll need to find a large and sturdy work-space for it.

The basic model comes with 10MB of memory and includes Adobe PostScript Level 2 support with 39 PostScript outline fonts. You can increase the memory capacity in 4MB increments to a maximum of 22MB. If you have 14MB or more memory installed in the 300i, it will also

provide PCL 5 and HPGL emulation with automatic emulation switching. Standard features include parallel, serial, and LocalTalk interfaces (plus a SCSI port for a local hard disk). An internal Ethernet adapter is



HEAVY DUTY: The 300i prints at tabloid size.

available as an option.

The 300i is driven by an AMD 29000 RISC processor running at 24 MHz. The controller uses an interleaved memory to improve performance.

PRINT QUALITY CHOICES

You choose the output quality you want with controls that are accessible through a well-designed Windows printer interface. There are three different print modes—standard, enhanced, and premium—and each has its own trade-off between speed and quality. Tektronix rates standard as four times faster than premium, but premium is designed to eliminate the banding that is sometimes visible in standard-mode outputs.

There's also a feature called Finepoint, which is designed to improve the contrast and to smooth edges of all types of images, including photographs, line art, and text.

You can select different color corrections (or create your own custom settings) using a feature called TekColor. This feature comes with predefined settings—Vivid Blue, Simulated Display, and SWOP (Specifications for Web Offset Publications).

The printer can automatically identify points where the cyan, magenta, and yellow inks are applied at 100-percent levels and will automatically replace those instructions with single dots of black ink instead.

LARGE, FAST PRINTOUTS

It's great that the 300i can print on pages of up to 12 by 18 inches (1 inch larger in each dimension than standard 11- by 17-inch ledger sheets). Its printable area of 11.6 by 17.5 inches will be a hit with graphic artists, since they can then create full-bleed images on tabloid-size sheets. The printer can handle 16- to 40-pound paper in the paper tray and up to 120-pound cover stock through the manual-feed slot.

Tektronix rates the 300i as twice as fast as the III PXi: 1 minute per letter-size page in standard mode, 2 minutes per page in enhanced, and 4 minutes in premium. On PC Labs' Graphics Speed test (using stan-

Adobe Photoshop image took 1 minute to transfer to the printer, and then another 53 seconds until the page dropped into the output tray, for a total of 1 minute 53 seconds. Premium mode also took 1 minute to transfer plus 2 minutes 12 seconds to print, or 3 minutes 12 seconds total. And with the Finepoint feature enabled under premium mode, the transfer time rose to 1 minute 20 seconds, plus 2 minutes 33 seconds to print, for a total of 3 minutes 53 seconds.

The 300i's print quality is mixed. It's not designed to be a great text printer, and its text output has jaggies at 300 dpi, though this problem is diminished when you enable Finepoint. The standard-output mode produces some visible banding, though premium mode greatly reduces banding. Halftone images look much sharper with Finepoint enabled, though you can lose some dark details and edges within the image.

The 300i is versatile and produces attractive output with impressive speed. Graphic artists may find the 300i's features useful, but for general business use, the 300i will find it difficult to compete with other plain-paper color printers that cost far less and produce output



OUTPUT SAMPLES: CMYK (left) and RGB (right) are supported.

dard mode), the 300i managed 0.82 graphics pages per minute (considerably faster than the 0.2 gppm of the Phaser III PXi).

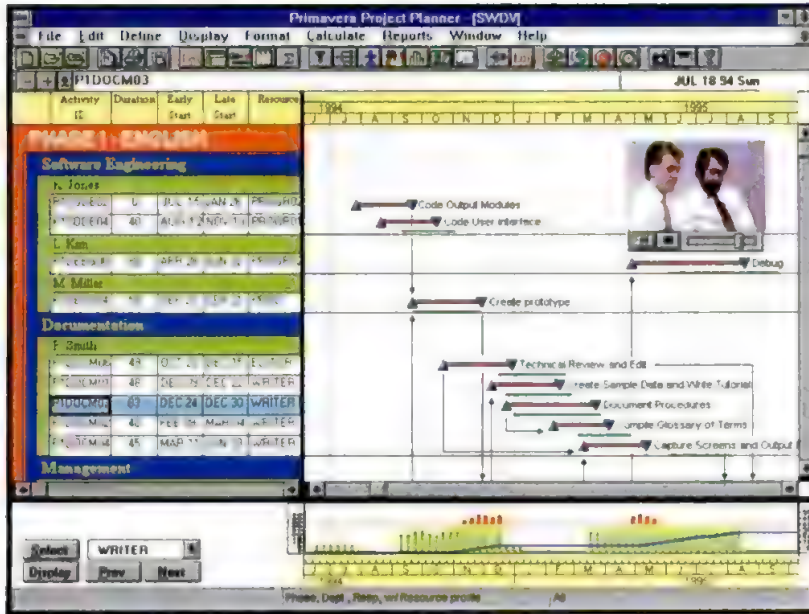
We also tested the effects of the different modes on performance. In standard mode, an

of at least the same quality.

• List price: Tektronix Phaser 300i, \$9,995. Tektronix Inc., P.O. Box 1000, MS 63-630, Wilsonville, OR 97070; 800-835-6100, 503-682-7377; fax, 503-685-3063. Circle 425 on reader service card

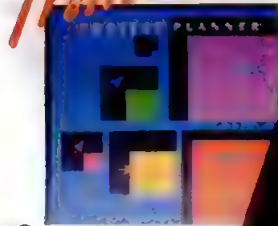
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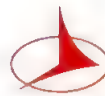
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■ Spreadsheets

Lotus Live! 1-2-3 Goes Multimedia

BY CRAIG STINSON

If you're about to buy Lotus 1-2-3 for Windows and your system has a CD-ROM drive, Lotus has a deal for you. For the same price as the standard edition (\$495), you can get a multimedia version of the spreadsheet program. The benefits include a vastly simpler and quicker installation procedure, an animated demo of 1-2-3, a set of training movies, an audible proofreading utility, an OLE-server worksheet annotation applet, a media manager to help you organize embeddable objects, and even a tool for recording your own spreadsheet movies (this requires a sound board).

The 20 QuickMovie animations cover topics that range from the basic to the moderately complex. While a movie is playing, you can use the Toggle to Worksheet button to skip back and forth between the movie and your worksheet. Movies include sound and music, but Lotus provides the option of playing them silently (with text captions) in case you don't have a sound card or you don't want to disturb your coworkers.

Consultants and trainers can augment the movies supplied by the package using the included ScreenCam to record their own narrated demos. ScreenCam, which Lotus will soon be offering as a standalone product, is an OLE server, so you can embed your own demos in custom applications. Be aware that ScreenCam creates multimegabyte temporary files, so it's best suited for clips that run 5 minutes or less.

What you don't get with the Multimedia Edition is printed documentation. Instead, it comes with complete on-line text for the four books that come

with the standard edition and a nifty hypertext reader to help you find the information you need. (For an extra \$50, Lotus will send you a set of printed books.) The reader displays a text window alongside an outline window; you locate full-text items by double-clicking on the outline entries. In lieu of a printed manual's index, you're supplied with a strong search facili-



NOW PLAYING: Choose from among 20 movies.

ty that can search topic headings or full text and can accept Boolean queries.

The Multimedia Edition's one drawback is that its own documentation is skimpy. In fact, unless you read the copy on the back of the product box, you won't even find out that ScreenCam exists. Apart from that, the Multimedia Edition is a great implementation of 1-2-3.

• List price: *Lotus 1-2-3, Release 4 for Windows: Multimedia Edition*, \$495; upgrade, \$129. Requires: 4MB RAM, Microsoft Windows 3.1, CD-ROM drive; some features require a sound card. Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; 617-577-8500.

Circle 421 on reader service card

■ Laser Printers

Canon's LBP-860: A Strong Match for the LaserJet 4

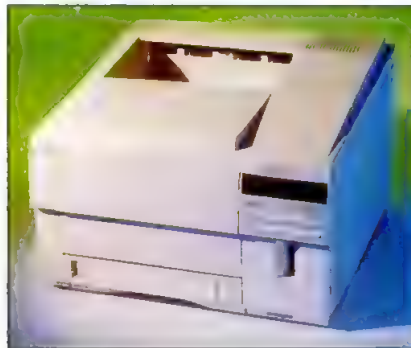
BY SCOT FINNIE

Since Canon manufactures the 600- by 600-dot-per-inch LBP-EX print engine found in the \$2,199 HP LaserJet 4, it's not surprising that the new \$1,839 Canon LBP-860 laser printer bears a strong resemblance to the LaserJet 4.

The LBP-860 is an 8-page-per-minute laser printer that prints at 600 and 300 dpi. Like the HP LaserJet 4, it comes with 35 Intellifonts and 10 TrueType resident fonts. It has a 20-MHz Intel i960 processor and 2MB of RAM, expandable to 34MB with industry-standard SIMMs. It has a 250-sheet paper drawer with a paper indicator and a 100-sheet multipurpose tray. The LBP-860 ships with parallel and serial ports and an empty port slot for an optional AppleTalk interface. But there's no Ethernet card for this slot, so the LBP-860 isn't an optimal network printer for the small office.

Print emulation in the LBP-860 is a respectable clone of the HP LaserJet 4's PCL 5e and is built by Peerless Systems. That's the same vendor that supplies

the LBP-860's Memory Reduction Technology (MRT) banding process. According to Peerless, the LBP-860 will routinely be able to print 8.5- by 11-inch, 600-dpi Adobe PostScript documents consisting of a half page of graphics and a half page



IMITATION IS FLATTERY: The Canon LBP-860 is in many ways like the HP LaserJet 4.

of text with just 2MB of memory. (Most other printers, including the HP LaserJet 4, require 6MB to print 600-dpi PostScript graphics gracefully.) Since Canon's PostScript Level 2 SIMM ROM module won't be available until late spring or early summer, we couldn't test this feature. The PostScript option will also give you automatic emu-

lation sensing and port switching.

Other differences between the printers are slight. The biggest is Canon's lack of a character-edge enhancement feature such as HP's Resolution Enhancement Technology. The LBP-860 cartridge slot is a proprietary PCMCIA type, so it won't accept HP cartridges, and Canon currently doesn't offer any cards for it. The LBP-860 does, however, use Superfine toner, and the paper indicator is easier to read

at a glance than HP's. Canon mounts its similar LED control panel on the front rather than the top of the printer.

The LBP-860 is a fine laser printer. If Memory Reduction Technology works as claimed, Canon's edge is a cheaper PostScript upgrade path, since you may not need extra RAM.

Of course, HP isn't standing still. It's reported to be updating the LaserJet 4 with a faster page-per-minute speed. If the new LaserJet's list price isn't raised significantly, it'll be a genuine value. So your best bet is to consider Canon's new offering, but you may want to wait and see what HP delivers.

• List price: *Canon LBP-860*, \$1,839. Canon Computer Systems Inc. 2995 Redhill Ave., Costa Mesa, CA 92626; 800-848-4123, 714-438-3000; fax, 714-438-3317.

Circle 401 on reader service card

Word Processing

HotDocs Builds Automated Templates in Windows Word Processors

BY EDWARD MENDELSON

HotDocs helps you convert standardized documents, such as contracts or purchase orders, into automated templates that can generate similar documents with just a few keystrokes. Capsoft's \$49 add-in enhances the template features of Ami Pro 3.0, Microsoft Word for Windows 2.0 or 6.0, and WordPerfect 5.2 or 6.0 for Windows by letting you build automated templates without programming.

These word processors come with programmable templates that prompt you to fill in blanks in order to create fax covers and similar documents. HotDocs makes it

easy to create similar templates without learning your word processor's programming language. You end up with templates that have built-in intelligence similar to Microsoft Word for Windows 6.0's Wizards.

You start with any document on your disk and use HotDocs' menus to replace names, numbers, dates, and other text with variables. You can also mark parts of the document as condi-

tional text that will appear in the final document either because a user selects it from a menu or because the sum of variables you set trigger its appearance in the document.

After you construct an automated template, you can use it as the basis for a new document just as you would any standard template that comes with your word processor. Dialog boxes constructed by HotDocs let you choose conditional text, fill in blanks to replace variables, and select from lists of names to fill variables in the text. You can add help text to any dialog box.

Creating a template is simple once you know how, but you

won't learn unless you follow every step of the supplied tutorial. You'll also need to understand your word processor's template feature before you begin. Using a template you've created takes no training at all:

The user simply fills in the blanks that have been created.

All major Windows word processors provide automated templates, but they probably don't do what you want. HotDocs makes it easy for you to build exactly the automated templates you need.

• **List price:** *HotDocs*, \$49. **Requires:** 2MB hard disk space, *Microsoft Windows 3.1*, and *Ami Pro 3.0*, *Microsoft Word for Windows 2.0* or *6.0*, or *WordPerfect 5.2* or *6.0* for Windows. *Capsoft Development Corp.*, 200 Sage Center, 226 West 2230 North, Provo, UT 84604; 800-500-3627, 801-375-6562;



From April 18 through April 22, you can go on-line to download an evaluation version of HotDocs for Windows Write or to discuss the program with Edward Mendelson, HotDocs product manager W. Kent Lundin, and senior developer Matt Morris. Type GO EXEC at any CompuServe! prompt.



SMART FILL: Documents are easy to build.

Utilities

OnTop: Helpful Windows Shortcuts Without Overhead Problems

BY DON WILLMOTT

Microsoft Windows does many things right, but it does enough things wrong to keep the market for add-on and replacement utilities thriving. Some utilities—like The Norton Desktop for Windows and PC Tools for Windows—are huge, and some—like Hewlett-Packard's Dashboard for Windows—are small. ThoughtWare's \$49.95 OnTop for Windows, Version 1.0, may be the smallest of all.

OnTop gets its name from the way it puts controls across the top of your Windows screen,

in the thin title bar where the name of the program you're running usually appears. You can run it either on top of Program Manager or as a Program Manager replacement.

You get a digital clock that counts each second, a button that links you to File Manager for file searching, and a resource monitor that you can leave on-screen to tell you what percentage of system resources and how much RAM is available.

The best part of OnTop is the Speed Launcher. This feature makes it very easy to create icons for your ten favorite appli-

cations, and you can attach specific files to the icons if you want to. It has Norton Desktop-like functionality without all the overhead. Ten icons are too few, of course, but the next release of the program, which will be called OnTop Professional and will include additional performance monitors and utilities, will accommodate 30 icons.

OnTop also has a file launcher, a button that shells you out to DOS, a button that will move the controls to the bottom of the

screen, and an easy-access menu for Windows accessories such as the Calculator.

One caveat: It turns out that you must be in 256-color mode or less when you assign icons to the Speed Launcher. This is a glitch that will be fixed in the next version, according to ThoughtWare. That version is expected soon, so if you want to give OnTop a try, the OnTop Professional version is the

one that you should get.

• **List price:** *OnTop for Windows, Version 1.0*, \$49.95. **Requires:** 2MB RAM, 1MB hard disk space, *Microsoft Windows 3.1*. *ThoughtWare Inc.*, P.O. Box 771, Helen, GA 30545; 706-865-9688; fax, 706-865-9455.



KEEP TRACK: The Resource Monitor.



UNOBTRUSIVE: OnTop's display stays out of the way in the Windows title bar.

Circle 427 on reader service card

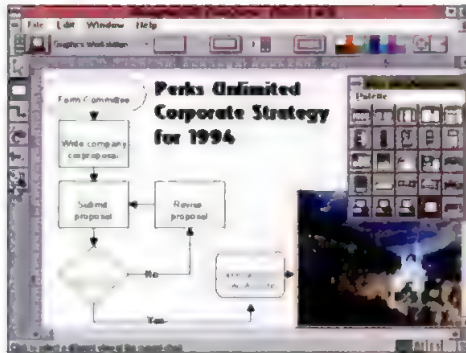
■ Flow Charting

Chart Attack: ABC FlowCharter 3.0 Focuses On Feedback

BY J. W. OLSEN

With its incremental enhancements, Micrografx ABC FlowCharter, Version 3.0 (\$495), remains the Windows flowcharting leader. Though the improvements might not inspire a casual user of the program to upgrade, the \$99 upgrade price (from previous versions or from competing programs) is good news for frequent flowchart or org chart designers.

ABC FlowCharter now provides OLE 2.0 support to integrate flowcharts with the rest of your documents. You can insert a flowchart into a word processing document, and you can



ABC FLOWCHARTER: Fully supports OLE 2.0 and offers 25 diverse shape palettes.

embed graphics, spreadsheet cells, animation, or sound into your flowchart. You'll note, though, that the program hasn't

yet implemented full OLE 2.0 in-place editing. If you are in your word processor and want to edit an embedded flowchart, you'll be taken back to ABC FlowCharter to do it.

The most obvious enhancements provide you with instant feedback while you build flowcharts. One good example is the changing cursor. When you work with text, it becomes a text-entry I-beam. When you draw lines, it becomes an arrow with an icon reflecting the active line's style.

The cursor also changes with location, particularly when the Object Selector tool is active. In that mode, the cursor is an arrow. Click on a shape to activate it and it will display its handles. While

within the shape, the cursor is accompanied by a four-headed arrow to indicate that you can click and drag the object. Move the arrow over a handle and it becomes a two-headed cursor to stretch or shrink the shape.

ABC FlowCharter has nine new shape palettes for a total of 25—far more than its competitors. A new one-to-many line connector is great for creating occasional org charts. Org chart lines can exit a shape in any direction for top-down, bottom-up, or horizontal charts.

All these usability improvements have made ABC FlowCharter 3.0 unbeatable in its class.

• List price: Micrografx ABC FlowCharter, Version 3.0, \$495. Requires: 4MB RAM, 6MB hard disk space, Microsoft Windows 3.1. Micrografx Inc. 1303 Arapaho, Richardson, TX 75081; 800-676-3110, 214-234-1769; fax, 800-994-6475.

Circle 418 on reader service card

■ Internet Access

Cello and Mosaic: Two Free Tickets Around the Internet

BY RICK AYRE

Cello and Mosaic are two examples of a new breed of software designed to make browsing the Internet easier.

Both use graphical environments to make access to the huge international network as simple as possible. Cello 1.0 is brand new and available only for Windows. Mosaic is already used on the Mac and under X Window; we previewed the Windows version.

Both of these programs require a direct Internet connection, TCP/IP software, and Windows sockets software that is compatible with WinSock 1.1. Both programs are available

for free on the Internet.

You can download Cello as CELLO.ZIP from Cornell Law School at ftp.law.cornell.edu in the directory pub/LII/Cello. You can download Mosaic as

WMOS20A1.ZIP from the University of Illinois's Supercomputing Center at ftp.ncsa.uiuc.edu in the directory PC/Mosaic. Both sites also offer graphics viewers.

Cello and Mosaic were designed specifically to browse World Wide Web (WWW) servers and to read the hypertext documents created for such servers. WWW servers host documents formatted in HTML (Hypertext Markup Language). The hyper-

text dynamic links are used to jump within a document or between documents on the same or on different servers.

For example, you can start out viewing the home page of

click on red Mosaic text, you can jump to the home of Mosaic at the University of Illinois at Champaign-Urbana. In a few minutes, with a few mouse clicks, you've traveled halfway

around the world.

Both programs also aim to be complete Internet front ends by supporting Telnet and FTP (both are parts of the Internet's infrastructure) and by being able to interpret Internet Gopher menus, the front ends to Unix systems that allow public access. Cello can even read posts from Usenet news groups.

While these programs are great for browsing, they aren't very good tools for finding a specific

piece of information on the Internet. In fact, we couldn't even use them to find any complete documentation on HTML, though we found many short descriptions. Nevertheless, either one will help you navigate the nebulous world of the Internet.



From April 11 through April 15, you can go online to download complete versions of Cello and Mosaic and to discuss them with Rick Ayre and representatives for each product. Type GO EXEC from any CompuServe prompt.



CELLO: Putting a new face on the Internet.

the PC Week WWW server in Cambridge, Massachusetts. One dynamic link on the page, viewed in red, is WWW. When you click on it, you jump to the home of WWW at CERN, the European Laboratory for Particle Physics. Then when you

PC Buyer C'mon Down!



Get A Fortune Of Value

PC buyers jump for joy! You're entering the exciting and competitive game of computer buying! We know you want to finish first with high-performance PCs and prize-winning service at the most affordable prices in the industry. It's no contest – with Gateway 2000™ you'll always be the big winner!

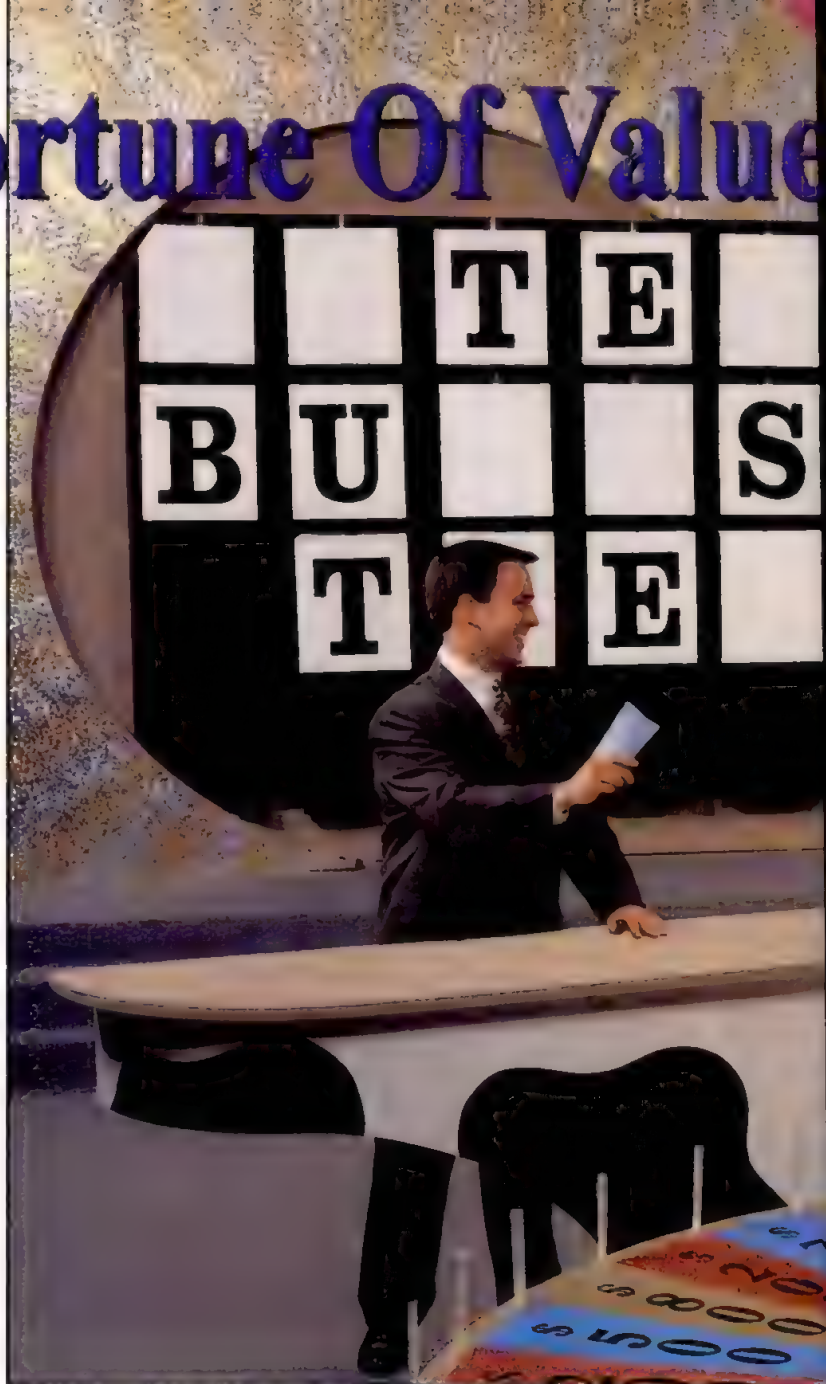
The Champ

And here are the stars of our show, Gateway's Pentium™-based systems! Starting from \$2,495 you get stupendous features. New lightning-fast hard drive systems! Screaming new graphics controllers on our two high-end P5 systems! Along with the most powerful Intel® processors available today! And (*drum roll please*) – all this at 486 prices!

Now in all four Gateway 2000 P5 systems, a new PCI/IDE controller allows the hard drive to transfer data *up to twice as fast* as non-PCI-based systems. The PCI/IDE controller is a major enhancement to Gateway's Intel Pentium processor and PCI local bus. Now you can access data faster than ever before!

Our P5-66 and top-of-the-line P5-60 now include high-end graphics controllers. So you can really take advantage of the performance-boosting PCI bus for virtually unbeatable graphics performance! These graphics controllers are also available as an upgrade option for all Gateway's PCI-based systems.

The standard graphics system on other Gateway PCI-based machines is another sure winner. You get 2MB standard graphics memory giving you 64,000 colors at 1024 x 768 resolutions. This graphics system uses a high-performance interface to graphics memory that achieves 16 million colors, true 24-bit, in VGA.



Been spinning your wheels on how to get tomorrow's technology today and still pay 486 prices? The puzzle is solved. With a price tag between \$2,495 and \$3,995, you'll hit the jackpot when you buy a Pentium-based system from Gateway 2000!

We also offer a full line of 486 PCI local-bus and integrated desktops systems. All are upgradable to a Pentium OverDrive™ Processor for the power you'll need in the future.

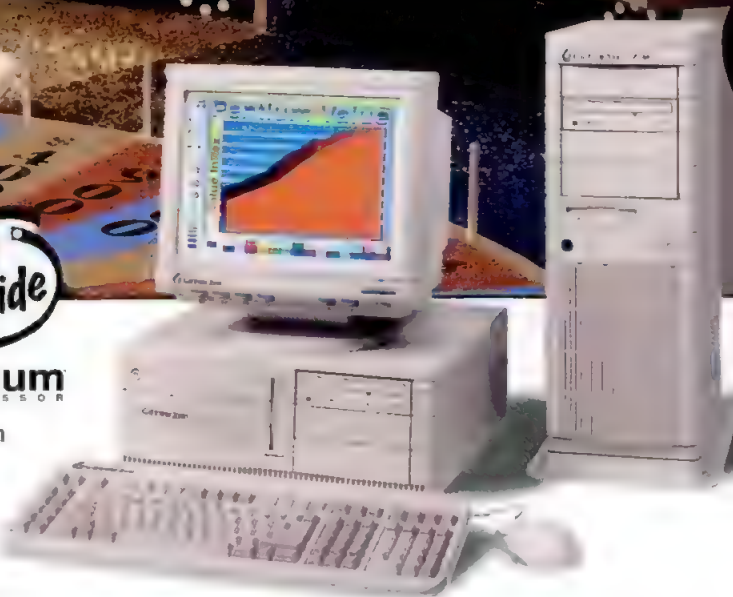
With Gateway 2000!



pentium
PROCESSOR

The Home Version

Fun and games are only part of what you get with the Gateway 4DX2-50 Family PC™. This special system includes full multimedia capabilities and software choices for the whole family. The Family PC brings productivity, education *and* entertainment into your home.



8 0 0 - 8 4 6 - 2 0 6 3

"X" Marks The Spot

Looking for the perfect portable PC? You'll get a celebrity performance when you choose Gateway 2000™ for the most value-packed portable PCs in the industry!



Gateway has all the right answers for incredible values with the ColorBook! Performance-enhancing features ... fast 486 processors and an incredibly big 10.3-inch screen on the DX4 model! ... make the ColorBook an undisputed champion.

Introducing the ColorBook DX4-75 with a faster-than-ever processor! This substantial power boost has made the DX4-75 the fastest 486 portable available today. And that's not all. For your extreme viewing pleasure, an extra-huge 10.3-inch dual-scan VGA color screen is now standard on the DX4. You won't find anyone else with a 10.3-inch screen at a better price.

All ColorBook models – 486SX-33, DX-33, DX2-50 and DX4-75 – have a host of great features. Weighing less than 5.7 pounds and measuring an ultra-thin 1.77 inches, the ColorBook supports simultaneous video; an easy-to-use, built-in trackball; two PCMCIA Type II slots; great battery life; and a suspend/resume feature so you can stop work anytime and resume later without losing data or restarting the system.

GATEWAY2000 HANDBOOK® 486

The revolutionary Gateway HandBook 486 is perfect for all your worldly travels. This powerful little performer will forever change the way you use a PC. And you won't have to think twice about taking it with you – no matter where you



go. It's a no-brainer. The HandBook is so small (*about the size of a day planner*) and so lightweight (*it's less than three pounds*) that you'll never want to be without it!

Unless you mind all the extra attention, as described by a leading columnist: "I almost got mobbed the other day on the train. I was doing what I usually do on the commute: writing on a notebook computer. The only difference was that I was using a Gateway 2000 HandBook 486 ... I can't wait until everyone has one. Then they'll leave mine alone."

For Portables!

MARKY MARKDOWN

THE KING

DAKOTA



The HandBook is a real PC with a powerful 486 processor; an IDE hard drive up to 130MB; standard 4MB or 8MB RAM upgradable to 20MB; a 7.9-inch bright, backlit VGA display screen; 78-key keyboard; EZ Point™ integrated pointer; excellent battery life; and suspend/resume feature.

Looking for a square deal on the best portables around? The odds are stacked in your favor with Gateway's ColorBook and HandBook portable PCs.



GATEWAY2000
"You've got a friend in the business."®

8 0 0 - 8 4 6 - 2 0 6 3

The Surveys Say...



Gateway 2000™ is the name of the game when it comes to the best service and support. The Gateway family is made up of hard-working Midwesterners who are dedicated to satisfying our customers. And although we're a Fortune 500 company, we haven't forgotten our simple philosophy of providing an honest value, a superior product and the best service possible. In return, Gateway's loyal customers are always there to cheer us on. But you don't have to just take our word for it. The surveys prove it!

Hands Down Winner in Service and Reliability

A big thank you to readers of *PC Magazine* who responded to a Service and Reliability survey with impressive results: "In our latest survey, only Gateway 2000 gets our highest rating in both the desktop and laptop categories." The survey covered reliability, satisfaction with repair experience, satisfaction with technical support, and the likelihood of buying new PCs from the same vendor again.



All the talented people appearing in this ad are Gateway 2000 employees.

HANDBOOK 486

- Weight: 2.94 Lbs.
- Dimensions: 9.75" x 5.9" x 1.6"
- SL Enhanced Intel® 486 Processor
- 4MB or 8MB RAM (expands to 20MB)
- 80 to 130MB IDE Hard Drive
- 7.9" Backlit VGA Display
- NiMH Battery & AC Pack
- Suspend/Resume Feature
- 1 PCMCIA Type II Slot
- EZ Point™ Integrated Pointer
- 78-Key Keyboard
- Parallel, Serial & PS/2 Ports
- MS Works for Windows™ 3.0
- MS-DOS 6.2, WFW 3.11 & Serial Transfer Cable

HANDBOOK 486SX-25

With 25MHz 486SX CPU, 4MB RAM and 80MB Hard Drive
\$1495

(with 130MB Hard Drive)
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HANDBOOK 486DX2-40
With 40MHz 486DX2 CPU, 8MB RAM, 130MB Hard Drive, Extra NiMH Battery, and Leather Carrying Case
\$2295

HANDBOOK 486SX-25
With 25MHz 486SX CPU, 8MB RAM, 130MB Hard Drive, and Leather Carrying Case
\$1895

PORTABLE OPTION

PCMCIA Cards:

- TelePath 14400/14400 fax/modem. **\$249**
- 9600/2400 fax/modem. **\$149**
- Ethernet adapter. **\$149**
- Token Ring adapter. **\$449**
- HandBook VGA adapter. **\$229**

Batteries:

- 2.2Ah NiMH batteries. **\$89**
- Alkaline battery pack. **\$29**

Diskette Drive:

- HandBook external 1.44MB. **\$99**

Cases:

- ColorBook **\$49**, HandBook **\$55**

Extended VIP Warranty:

- We'll ship a replacement within 24 hours during warranty. Point of sale only. **\$100**

COLORBOOK

- Weight: Under 5.7 Lbs.
- Dimensions: 11.7" x 8.5" x 1.77"
- SL Enhanced Intel 486, DX2 or DX4 Processors
- 4MB or 8MB RAM (expands to 8, 12 or 20MB)
- 3.5" 1.44MB Diskette Drive
- Removable 120 to 250MB IDE Drive
- 10.3" or 9.4" VGA Dual-Scan STN Color Display
- NiMH Battery & AC Pack
- Suspend/Resume Feature
- 2 PCMCIA Type II Slots
- Integrated Trackball (2 buttons)
- 85-Key Keyboard
- Parallel, Serial & PS/2® Ports
- External VGA Port
- MS Works for Windows 3.0
- MS-DOS 6.2 & WFW 3.11

COLORBOOK DX4-75
With 75MHz DX4 CPU, 8MB RAM, 250MB Hard Drive and 10.3" LCD
\$3495

COLORBOOK 486SX-33
With 33MHz 486SX CPU, 4MB RAM, 120MB Hard Drive and 9.4" LCD
\$1995

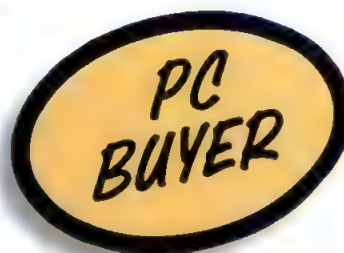
COLORBOOK DX-33
With 33MHz DX CPU, 4MB RAM, 170MB Hard Drive and 9.4" LCD
\$2495

COLORBOOK DX2-50
With 50MHz DX2 CPU, 8MB RAM, 250MB Hard Drive and 9.4" LCD
\$2995

COLORBOOK PACKS

Traveler's Packs:

- Case, extra battery & PCMCIA 9600/2400 fax/modem. **\$279**
- Case, extra battery & PCMCIA TelePath fax/modem. **\$369**



SOFTWARE & GAMES

If a system comes with "choice of application software," choose one of the following packages:

- Microsoft Excel for Windows™
- Microsoft Word for Windows™
- Microsoft Word and Bookshelf®, CD-ROM Edition
- Microsoft PowerPoint for Windows™
- Microsoft Project for Windows™
- Microsoft Access™ for Windows
- Publisher's Pack (CD-ROM only; includes CorelDRAW 3,™ ArtShow, MS Publisher 2.0 & MS Design Pack)

- The Entrepreneur Pack (Works,™ Publisher,™ Money™ & games)
- Borland Paradox® database and Quattro® Pro for Windows spreadsheet
- Borland Paradox® and C++ With desktop and selected portables you also get the following software and extras at no additional charge:
- MS-DOS 6.2 & Windows for Workgroups 3.11
- CoSession™ Host Remote Diagnostics (with all modems)

- QAPLUS Diagnostics
- Gateway Computer Glossary
- Gateway Mouse Pad
- Systems with CDs also include:
- Gateway System CD
- Multimedia On-Line User's Guide
- Gateway Mail On-Line Catalog

SERVICE

Every Gateway system is backed by:

- 30-Day Money-Back Guarantee
- One-Year Limited Warranty
- Lifetime Toll-Free Technical Support
- On-Site Service Available To Most Locations
- Lifetime BBS Membership
- FaxBack Automated Fax Service

Our money-back guarantee does not include shipping. On-site service is provided at no charge during warranty if our technicians determine it is necessary. If you'd like to read our warranty and guarantee policies, please call for a free copy.



Printed on recycled paper with soy inks.

Gateway 2000 is a corporate sponsor of
GLOBAL RECYCLE



Ready For Action

Gateway 2000's friendly employees will take care of you from your first phone call throughout the life of your system with lifetime technical support. We've also made it easy for you to buy one of our world-famous PCs.



get a variable interest rate of 13.9% APR and a low \$18 annual fee.*

**Cash advance fee is \$1 plus 2% of the amount of the cash advance, but not less than \$5 nor more than \$10. Financing is available on approved credit with the Gateway DuoLine MasterCard, issued by Dial National Bank, Des Moines, Iowa.*

Internationally Known

Gateway 2000 also makes it easy for our neighbors in Canada and Puerto Rico to buy Gateway systems. You get the same award-winning technical support, CSA approvals, and on-site service that is available in most Canadian and Puerto Rican locations. Our international shipping rates are some of the most competitive in the industry. Canadian and Puerto Rican customers can reach us toll free at 800-846-3609. All other international customers can call us at 605-232-2000.

Our Family PC comes with a 14-inch CrystalScan monitor, 101-key keyboard, double-speed CD-ROM, sound card, speakers, joystick, fax/modem and multimedia software. You choose one software option from five great Family PC multi-title packages.



Easy Payment Options

Gateway accepts most major credit cards and C.O.D. terms, with net 30-day terms and leasing options available to qualified commercial customers.

You can also apply for our new Gateway 2000 DuoLine MasterCard® Card, issued by Dial National Bank, which lets you make purchases from Gateway and anywhere else MasterCard is accepted by giving you two lines of credit — one for Gateway purchases and one for all other purchases. For Gateway purchases, the card has no annual fee and a low variable interest rate of just 12.9% APR. For other transactions, you



8 0 0 - 8 4 6 - 2 0 6 3

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Foldout slip-sheet



GbsSlipSheet-001

Folded edge of the page

Inverted Foldout slip-sheet

1. Open the foldout page

2. Insert this sheet with

1. Front side touching the free page

2. Arrow pointing to the fold

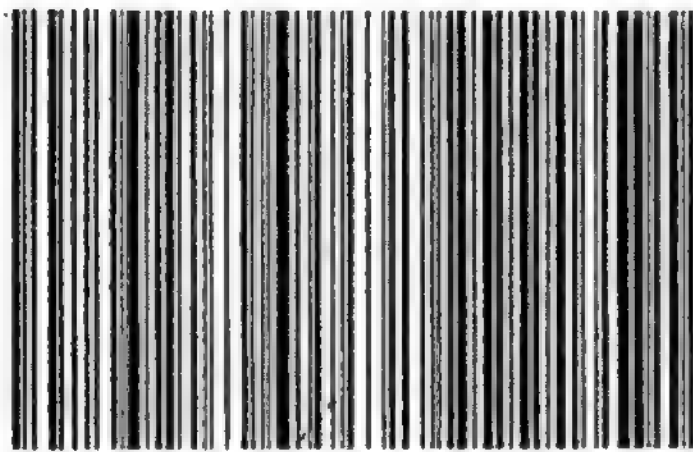
3. Slice the folded edge

4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back



GbsSlipBack-001B

Back

1. Follow instructions on the other side



World Class Winning

PC World's 1993 World Class Awards found readers honoring Gateway 2000 with top honors in five categories including Best Service and Support (for the second year in a row!) and Best Mail Order Company. Thank you, *PC World* readers!

Jesse Berst, editor of *Windows Watcher* was quoted in *PC World*: "Gateway has discovered an amazing secret, give people more for less and they are going to like you." We knew our secret wouldn't be safe for long!



Good Answers!

Computer Shopper summarized its readers' responses best: "Gateway, dominator of Best Buy balloting for the past three years, is your choice as Best Overall Supplier of computer systems ... For state-of-the-art PCs at bargain prices, North Sioux City is where *Shopper* readers look first." And "...Gateway 2000 has inspired a high degree of confidence and brand loyalty among *Shopper's* readers, who continue to rank Gateway's service and support as the best of all direct-channel PC vendors." Thanks *Shopper* readers!



INTEGRATED SYSTEMS

4SX-33

- Intel® 33MHz 486SX CPU
- 4MB RAM
- 212MB 13ms IDE Hard Drive
- Local Bus Graphics with 1MB
- 3.5" Diskette Drive
- 14" Color CrystalScan® 1024NI
- Mini Desktop Case
- 5 16-Bit ISA Slots
- 101-Key Keyboard & MS Mouse
- MS-DOS® 6.2 & WFW™ 3.11
- MS Works for Windows™ 3.0
- EPA Energy Star Compliant

\$1295

4DX-33

- Intel 33MHz 486DX CPU
- 4MB RAM
- 212MB 13ms IDE Hard Drive
- Local Bus Graphics with 1MB
- 3.5" Diskette Drive
- 14" Color CrystalScan® 1024NI
- Mini Desktop Case
- 5 16-Bit ISA Slots
- 101-Key Keyboard & MS Mouse
- MS-DOS® 6.2 & WFW™ 3.11
- MS Works for Windows™
- EPA Energy Star Compliant

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4DX2-50 FAMILY PC™

- Intel 50MHz 486DX2 CPU
- 8MB RAM, 128KB Cache
- 212MB 13ms IDE Hard Drive
- Local Bus Graphics with 1MB
- Double-Speed CD-ROM, 16-Bit Sound Card & Speakers
- 2400/9600 Data/Fax Modem
- 3.5" Diskette Drive
- 14" Color CrystalScan 1024NI
- Mini Desktop Case
- 5 16-Bit ISA Slots
- 101-Key Keyboard, MS Mouse & Joystick
- Choice of Family PC Software
- EPA Energy Star Compliant

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MULTIMEDIA KIT

Here's everything you need to add multimedia to any Gateway desktop PC. You won't find a better price anywhere!

- Gateway 2000 16-Bit Sound Card, Sound Blaster™-Compatible
- Double-Speed CD-ROM
- 2 Labtec® Speakers
- Microsoft Encarta & Corel Photo CD Software

\$299

486 VESA & PCI SYSTEMS

4SX-33V

- Intel 33MHz 486SX CPU
- 4MB RAM
- 212MB 13ms IDE Hard Drive
- VLB™ Graphics with 1MB
- Local Bus IDE Interface
- 5.25" & 3.5" Combo Drive
- 14" Color CrystalScan® 1024NI
- Baby AT Case
- 5 ISA & 2 VESA®/ISA Slots
- AnyKey® Keyboard & MS Mouse
- MS-DOS 6.2 & WFW 3.11
- Choice of Application Software
- EPA Energy Star Compliant

\$1495

P4D-33

- Intel 33MHz 486DX CPU
- 8MB RAM, 256KB Cache
- 424MB 13ms IDE Hard Drive
- PCI Local Bus Graphics with 1MB
- Double-Speed CD-ROM
- PCI Fast IDE Interface
- 3.5" Diskette Drive
- 14" Color CrystalScan 1024NI
- Baby AT Case
- 4 ISA, 2 PCI & 1 PCI/ISA Slots
- AnyKey Keyboard & MS Mouse
- MS-DOS 6.2 & WFW 3.11
- MS Works Multimedia Edition 3.0

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4DX2-66V

- Intel 66MHz 486DX2 CPU
- 8MB RAM, 128KB Cache
- 424MB 13ms IDE Hard Drive
- VLB Graphics with 1MB
- Double-Speed CD-ROM
- Local Bus IDE Interface
- 3.5" Diskette Drive
- 15" Color CrystalScan 1572FS
- Baby AT Case
- 5 ISA & 2 VESA/ISA Slots
- AnyKey Keyboard & MS Mouse
- MS-DOS 6.2 & WFW 3.11
- Choice of Application Software
- EPA Energy Star Compliant

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P4D-66 BEST BUY

- Intel 66MHz 486DX2 CPU
- 8MB RAM, 256KB Cache
- 540MB 13ms IDE Hard Drive
- PCI Local Bus Graphics with 2MB
- Double-Speed CD-ROM
- PCI Fast IDE Interface
- 3.5" Diskette Drive
- 15" Color CrystalScan 1572FS
- Baby AT Case
- 4 ISA, 2 PCI & 1 PCI/ISA Slots
- AnyKey Keyboard & MS Mouse
- MS-DOS 6.2 & WFW 3.11
- Choice of Application Software

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PENTIUM SYSTEMS

P5-60

- Intel 60MHz Pentium™ CPU
- 8MB RAM, 256KB Cache
- 424MB 13ms IDE Hard Drive
- PCI Local Bus Graphics with 2MB
- PCI Fast IDE Interface
- 3.5" Diskette Drive
- 14" Color CrystalScan 1024NI
- Baby AT Case
- 4 ISA, 2 PCI & 1 PCI/ISA Slots
- AnyKey Keyboard & MS Mouse
- MS-DOS 6.2 & WFW 3.11
- MS Works for Windows 3.0

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P5-60 BEST BUY

- Intel 60MHz Pentium CPU
- 8MB RAM, 256KB Cache
- 424MB 13ms IDE Hard Drive
- PCI Local Bus Graphics with 2MB
- Double-Speed CD-ROM
- PCI Fast IDE Interface
- 3.5" Diskette Drive
- 15" Color CrystalScan 1572FS
- Baby AT Case
- 4 ISA, 2 PCI & 1 PCI/ISA Slots
- AnyKey Keyboard & MS Mouse
- MS-DOS 6.2 & WFW 3.11
- Choice of Application Software

\$2795

P5-60

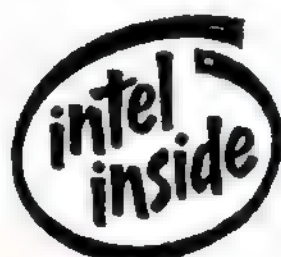
- Intel 60MHz Pentium CPU
- 16MB RAM, 256KB Cache
- 540MB 13ms IDE Hard Drive
- High-Performance PCI Local Bus Graphics with 2MB
- Double-Speed CD-ROM
- PCI Fast IDE Interface
- 3.5" Diskette Drive
- 15" Color CrystalScan 1572FS
- Baby AT Case
- 4 ISA, 2 PCI & 1 PCI/ISA Slots
- AnyKey Keyboard & MS Mouse
- MS-DOS 6.2 & WFW 3.11
- Choice of Application Software

\$3295

P5-66

- Intel 66MHz Pentium CPU
- 16MB RAM, 256KB Cache
- 540MB 13ms IDE Hard Drive
- High-Performance PCI Local Bus Graphics with 2MB
- Double-Speed CD-ROM
- PCI Fast IDE Interface
- 16-Bit Sound Blaster-Compatible Sound Card & Yamaha Speakers
- 3.5" Diskette Drive
- 17" Color CrystalScan 1776LE
- Tower Case, 300W Power Supply
- 4 ISA, 2 PCI & 1 PCI/ISA Slots
- AnyKey Keyboard & MS Mouse
- MS-DOS 6.2 & WFW 3.11
- Choice of Application Software

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Extra Winnings

You'll score bonus points with the peripherals listed below, sold only with the purchase of a system from Gateway 2000. Call our special component add-ons division for our complete line of extras for Gateway customers.

Multimedia

Multimedia Kit

Here's everything you need to add multimedia to your Gateway PC:

- Gateway 2000™ 16-bit CD-quality sound card, compatible with Sound Blaster™ cards, with MIDI/game port, mic in, stereo line in/out
 - Double-speed CD-ROM drive, tray-loading, compatible with music CDs, multisession photo CDs and CD-ROM titles
 - 2 Labtec® speakers that can attach to your PC monitor
 - Microsoft® Encarta Multimedia Encyclopedia
 - Corel Professional Photo CD Sampler
- \$299**

Yamaha® YST-M10 Multimedia Speakers

The small speakers that sound big and come with a tiny price! This free-standing, self-powered speaker set is a great value!
\$75

Altec Lansing ACS-300 Multimedia Speakers

Get superior stereo sound with these top-rated Altec Lansing ACS-300 speakers with separate powered subwoofer. **\$219**

Communications & Storage

TelePath™ II Fax/Modem

Internal fax/modem, 14,400bps modem, V.32bis, with 14,400bps fax capability. Package includes data and fax communication software, plus a CompuServe® trial membership. **\$149**

Colorado Memory Systems® TBU

250MB internal automatic tape backup unit copies up to 9.5MB per minute. Comes with MS Windows™ and DOS® software, one tape and cable. **\$159**

Networking

Intel EtherExpress™

A 16-bit Ethernet adapter from a world leader in networking.
\$105 Twisted Pair or BNC

Ethernet Adapter from 3Com®

Manufactured by 3Com for Gateway.
\$105 Twisted Pair **\$125** BNC

Token Ring

IBM® 16-bit ISA Token Ring card. **\$429**

Monitors

CrystalScan® 17-Inch Monitor

Non-interlaced color monitor with intelligent multiscanning analog color display capable of ultra-high resolution up to 1280 x 1024 in non-interlaced mode and .26mm dot pitch.

Upgrade from a 14-inch monitor **\$430**

Upgrade from a 15-inch monitor **\$350**

(Prices good only for upgrades at the time of system purchase.)

Printers

Epson® Stylus 800 Ink Jet Printer

Great laser quality at an ever greater value. Measuring only 17 inches by 10.5 inches, the Stylus 800 has seven different typefaces and prints an extra-quiet 150 characters per second at 360dpi. Parallel cable included. **\$289**

Epson ActionLaser 1500 Laser Printer

The ActionLaser delivers professional-quality printouts. Fast six-page per minute speed, 14 resident fonts, 300 x 300dpi, and 1MB memory expandable to 5MB. Parallel cable included. **\$669**

Home Office Pack

Add these peripherals to your new Gateway desktop, and you have everything you need for an efficient home office.

■ Epson Stylus 800 Ink Jet Printer

■ TelePath II Fax/Modem

■ 1 Parallel Cable

\$399

■ Sound

Logitech and Turtle Beach Pump Up the Volume Under \$400

BY GREG PASTRICK

Multimedia sound fans toss around buzzwords like DSP algorithms, MIDI sample sets, wave table synthesis, and 16-bit recording. But here is a more interesting buzzword: bargains.

Sound-card vendors are putting together MPC-compliant hardware and software packages for under \$400, about what it cost to buy a midrange sound card just a year ago. Two new 16-bit sound cards—Logitech's Logitech SoundMan Wave and Turtle Beach Systems' Turtle Beach MultiSound Monterey—make the \$400 cut, and at \$349 the SoundMan Wave is well below it.

LOGITECH SOUNDMAN WAVE

Logitech has successfully evolved its line of SoundMan products with the upgradable and outstandingly easy-to-install SoundMan Wave. It's a full CD audio-quality card with 44 wave table and FM synthesis voices, 8- and 16-bit recording and playback, and AdLib/Sound Blaster support from either DOS or Windows.

Built with the Yamaha OPL-4 FM stereo synthesis chip and 2MB of ROM-based wave table samples, the SoundMan Wave supports 16 MIDI channels and 128 general MIDI instrument samples through its MPU-401 Roland interface. In addition, its five-channel mixer handles 6 watts per channel of amplified stereo output, while its complete array of I/O jacks and connectors give you plenty of sampling and playback options. You will find a SCSI CD-ROM interface, lines in and out for microphone

and CD recording or playback, and joystick port/MIDI kit interface connectors, too.

The SoundMan Wave's amplified stereo runs unpowered speakers, and its microphone and CD inputs let you record and cut audio samples at rates from 4 to 44.1 kHz.

All the mixing, recording, and playback software and drivers you need are included. On the Windows side, you get two excellent sound-processing packages in Animation's MCS Music-Rack and Midisoft's Recording Session. The SoundMan Wave also comes with two OLE-based utilities. Berkeley Speech Technologies' Bestspeech ReadOut gives you text-to-voice conversion from OLE-compatible applications, while Voyetra's SoundMan Annotator lets you paste messages into the same applications.

Just for fun, you also get Moon Valley's Icon Hear-It, which gives your Windows desktop some silly, noisy icons, while adding voices to other events and desktop functions.

MULTISOUND MONTEREY

Designed with technology lifted from its Rio, Tahiti, and Maui professional and personal sound products, the higher-end \$399 Turtle Beach MultiSound Monterey has many professional features. This card isn't meant for multimedia novices looking for easy entry into the world of sound.

Based on the Motorola DSP-56001, the Monterey is a full CD audio-quality card with 32 simultaneous wave table voices, 8- and 16-bit recording and playback, 48 MIDI channels, and 128 general MIDI samples.

The Monterey samples sound at levels from 11 to 44.1 kHz, as well as giving you a direct MIDI-interface connection for an external adapter. The Monterey's I/O jacks are limited to in, out, and auxiliary lines, and there is no direct SCSI connec-

tion for a CD-ROM. Note, also, that there is no Sound Blaster support.

Even without Sample Store, you get the same top-level PC-based sound processing and support that earned the original MultiSound an Editors' Choice designation. The Monterey simply improves on the quality of the MultiSound's features. Turtle Beach has replaced the Emu Proteus wavetable lookup chip with its new WaveFront synthesizer. WaveFront lets you add a long list of software selectable reverb and echo effects to your MIDI output. With this change, the MultiSound's standard for professional-quality MIDI composition is maintained and enhanced.

USE WITH WINDOWS

Since the card is designed for use with Windows, the set of proprietary Monterey utilities and Wave Sound Editor applications are unlike any you will find with other cards. The Monterey's control and mixing panel are supplemented by professional-level MIDI and diagnostic tools, and the Mouse Player is as much fun to play as it is to use for checking out sounds.

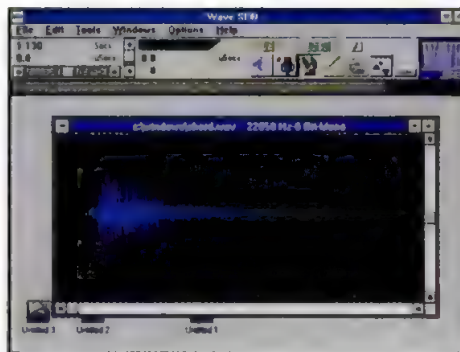
Turtle Beach's Wave Sound Editor software also gives you all the tools you need to manipulate sound files.

• List price: *Logitech SoundMan Wave*, \$349. Requires: 4MB of RAM, Windows 3.1. Logitech Inc., 6505 Kaiser Dr., Fremont, CA 94555; 800-231-7717, 510-795-8500; fax, 510-792-8901.

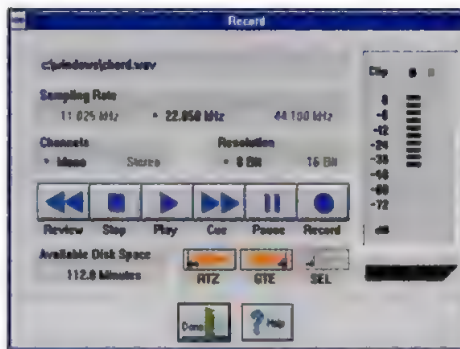
Circle 433 on reader service card

• List price: *Turtle Beach MultiSound Monterey*, \$399. Requires: 2MB RAM, Microsoft Windows 3.1. Turtle Beach Systems, 52 Grumbacher Rd., York, PA 17402; 800-645-5640, 717-767-0200; fax, 717-767-6033.

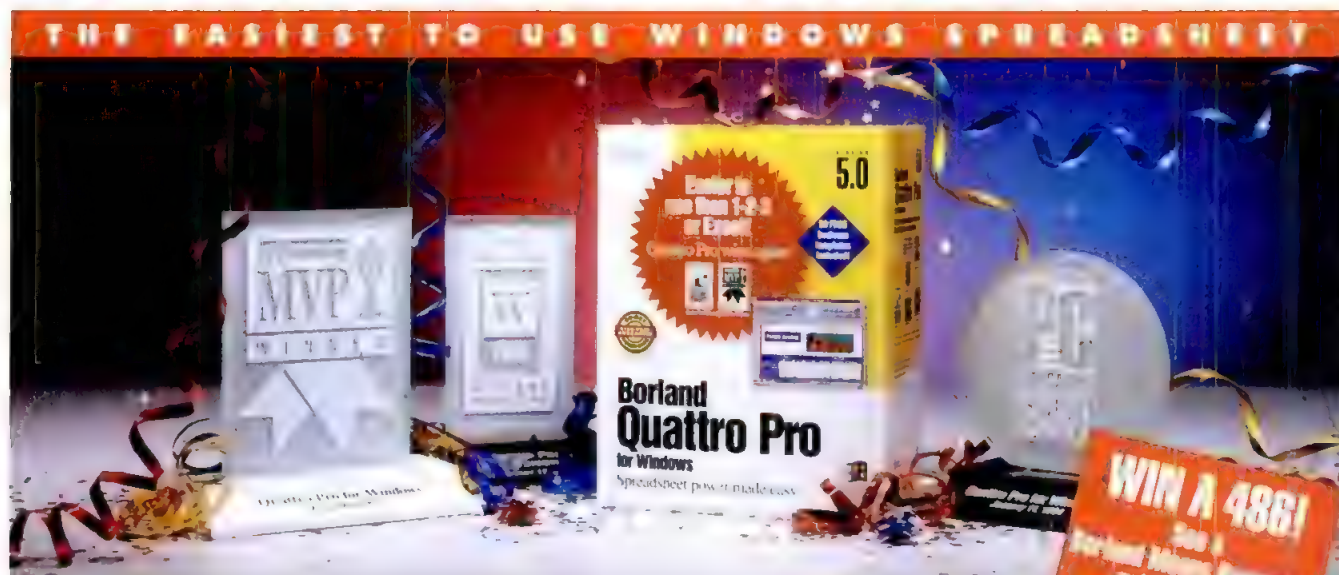
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WAVE EDITOR: Included with Monterey.



HI-FI: Monterey records at 44.1 kHz.



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—Computerworld, Jan. 1994

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CIRCLE 220 ON READER SERVICE CARD

■ Business Card Scanners

CardScan: Is the Newest Business-Card Reader the Best One Yet?

BY NEIL J. RUBENKING

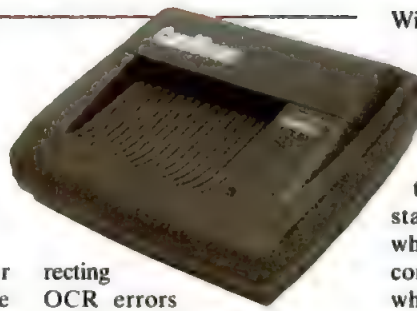
CardScan (\$395 with scanner), from Corex Technologies, relies on simplicity and accuracy to differentiate itself from other business-card scanners. It uses the same scanning hardware as Microtek's and Cypher-Tech's products (both reviewed in First Looks, December 7, 1993) and has the same potential IRQ (interrupt request) and DMA (direct memory access) conflicts. But the software's OCR (optical character recognition) analysis and interpretation of the scanned image rivals the best we've seen.

The scanner can read

about three or four cards per minute as a batch, and then the CardScan software analyzes the scanned images. You verify each card's data in the edit view, cor-



CARD TO SCREEN: The CardScan screen resembles a rotary card file and is just about as easy to use.



recting OCR errors and dragging and dropping misplaced fields to the right spot. Vertical business cards are no problem.

The CardScan database's edit view shows the data fields along with either a zoomable image of the card or up to 4K of notes. CardScan can import and export data in any comma-delimited or tab-delimited format and includes templates for 20 popular contact-management packages. Pre-defined print formats present the data as phone books, address books, or labels, and user-definable page layouts control the placement of printed data.

The free-form incremental search finds cards with matching text in any field, including notes.

With each letter you type, the list view shrinks to show only cards containing that text; usually three or four letters narrow the list sufficiently.

CardScan did a better than average job of reading standard-format, black-on-white business cards and low-contrast cards, such as gray on white or black on medium brown. Cards with very dark backgrounds and very light text didn't scan successfully.

Business-card scanning is meant to make recording contacts easier. A product that baffles you or requires a lot of hand editing is self-defeating. CardScan's simple interface, relatively accurate scanning, and well-designed on-line help system make it extremely easy to use.

• **List price:** CardScan, Version 1.0, \$395; software-only version for Twain-compatible scanners, \$149. Requires: 8MB RAM, 4MB hard disk space, Microsoft Windows 3.1. Corex Technologies Corp., 233 Harvard St., #207, Brookline, MA 02146; 800-942-6739, 617-277-5344; fax, 617-277-5069

Circle 420 on reader service card

■ Utilities

Praxim Brings a Command Line to Windows

BY EARLE ROBINSON

Wesson International's \$49.95 Praxim—Command Shell for Windows, Version 1.0, packs a punch many other more obtrusive Windows shells might envy.

Like many other Program Manager replacements, Praxim has a main toolbox, called Favorite Tools, that shows up on-screen as a small window displaying the buttons that launch all your applications. Other toolboxes for directories, disk images, hotkeys, and all the program groups are just a click or two away. Praxim uses the right mouse button to call up toolboxes and to modify them.

The program is more impressive for its ability to handle most

downs" at a C: prompt, for example, Praxim will find the Windows directory no matter what drive it's on.

You can launch any program from the Praxim command line,

whether that program is a DOS or a Windows application. Using the Praxim commands, you can modify the internal path, change environmental variables, and copy or rename files, all without leaving Windows or shelling out to DOS.

Like DOS, Praxim has a batch file language that lets you launch tasks easily. You write batch files using features that mirror those of DOS batch files. You can also search for files, evaluate mathematical expres-

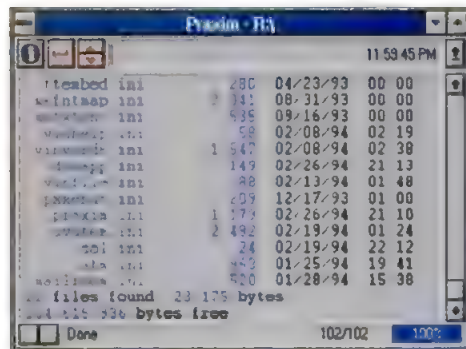
sions, prune directories, and change file dates and times.

Although this is undocumented in the manual, Praxim will serve as a complete Program Manager replacement. Using Praxim this way, we had 91 percent of resources available, far more than with Program Manager, and we used 1MB less RAM with Praxim running in the place of Program Manager.

At \$49.95, Praxim packs a lot of value in a small package, which will be especially attractive to notebook users or anyone whose computer has a small hard disk and limited memory.

• **List price:** Praxim—Command Shell for Windows, Version 1.0, \$49.95. Requires: 2MB free RAM, 2MB hard disk space, Microsoft Windows 3.0 or later. Wesson International Inc., 500 S. Capital of Texas Hwy., Bldg. 5, Austin, TX 78746; 800-634-9808, 512-328-0100; fax, 512-328-7838.

Circle 422 on reader service card



DOS LOOK: Get DOS-like listings.

DOS tasks directly. Praxim's command line lets you type in DOS commands. Praxim has several enhancements over DOS itself, including a smart version of CHDIR (change directory). If you type "cd win-

SIX THINGS YOU CAN'T DO WITH YOUR DISK DRIVE.

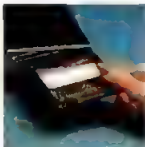
(Unless You Have A SyQuest.)

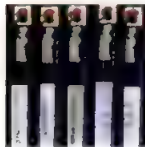
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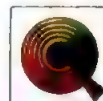
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■ Monitors

Nokia's 17-Inch Multigraph 447X Has Smart Controls

BY BRAD STILWELL

The Nokia Multigraph 447X's supremely sharp picture and clever on-screen menu controls make it a winning choice among 17-inch color displays.

The \$1,250 447X is the latest entry from the Finland-based Nokia Display Products, which began marketing brand-name color displays in the United States last year. The \$630 15-inch Nokia Multigraph 449E was an Editors' Choice in our 14- and 15-inch monitor evaluation ("14- and 15-Inch Monitors: Mainstream Choices," March 16, 1993).

STRONG COMPETITOR

As one of the few models using the sparkling 0.26-mm- aperture-grill Trinitron tube, the 447X is positioned well against the new generation of Nanao, NEC, and Sony 17-inch displays. It also uses Sony's silicon coating to effectively reduce screen glare.

The 447X will run without flicker at 1,280-by-1,024 noninterlaced resolution with a 75-Hz refresh rate, but most users will be content with 1,024-by-768 mode (with a maximum refresh rate of 95 Hz). Its active screen size of 15.3 inches is a full inch smaller than some 17-inch units, but the active screen area can be expanded to the bezel in order to remove any black border.

ZD Labs' objective scores and subjective evaluation found the 447X's display to have a sharpness and contrast that will please any eye. Our test unit had no visible blooming or pincushioning.

Testing did uncover misconvergence that flawed the screen's otherwise clear and bright image, however. Using a 3MB Matrox MGA Impression graphics accelerator, we saw two hairline bands of horizontal

misconvergence under Windows that couldn't be corrected by the monitor's controls.

IMAGE ADJUSTER

The 447X has an unusually sophisticated array of image adjustments, including trapezoidal, orthogonal, color-temperature, and tilt controls. All of these controls are accessed through on-screen menus that resemble

those that you find on TVs and VCRs—a rare control scheme for a monitor.

In ZD Labs' tests, the 447X unit powered down from 119.2 to 9.2 watts—well beneath



SHARP SCREEN: The 447X is a 17-inch contender.

Energy Star and VESA requirements—after the screen saver had been on for 3 minutes. The 447X also meets MPR II's guidelines for electromagnetic emissions, and Nokia will soon optionally offer compliance with the Swedish union TCO's stricter standard.

With its enviable image quality and abundance of image-perfecting adjustments, the 447X is competitive with the best 17-inch color monitors.

• List price: *Nokia Multigraph 447X*, \$1,250. *Nokia Display Products Inc.*, 3000 Bridgeway Blvd., Sausalito, CA 94965; 800-296-6542, 415-331-0322; fax, 415-331-6211.

Circle 426 on reader service card

■ PCMCIA

CardSharkII Puts PCMCIA Slots in Your Desktop PC

BY MITT JONES

If you haven't quite figured out why you would want to endow your desktop PC with a PCMCIA slot or two, think back to the last time you needed to move an application and several megabytes of data to your notebook PC before catching a flight the next morning. That's the kind of data portability challenge desktop PCMCIA slots are supposed to meet.

The CardSharkII (\$299 for the internal version; \$379 for the external version) provides everything your desktop PC needs to accommodate PCMCIA hard disks and other cards. Manufactured by Curtis Inc.—not to be confused with Curtis Manufacturing Co. Inc., the maker of the ubiquitous PC accessories—the CardSharkII accepts two Type I or Type II cards or one Type III card at any given time. Unlike some earlier dual-slot card drives, the CardSharkII also fully isolates its two slots. A card in one slot can be removed or exchanged even while the card in the other is being accessed.

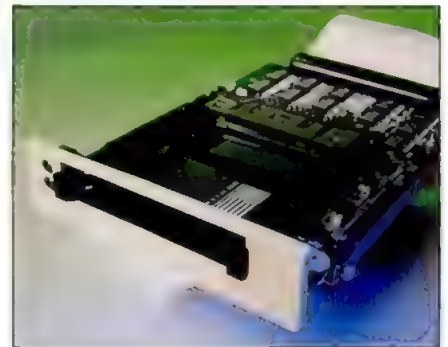
Both the internal and external versions come with a 16-bit ISA adapter and tap the I/O bus for necessary power. Hardware installation of the internal 3.5-inch drive is relatively easy. Curtis doesn't include a 5.25-inch mounting kit with the drive but will provide one free upon request.

Curtis does ship the full collection of SystemSoft Corp.'s Card and Socket Services software and card drivers with the CardSharkII. The software includes an automatic installation and configuration routine but requires manual exclusion of memory-manager RAM access. It allows plug-and-play use of most PCMCIA cards within Windows or without, and it doesn't force you to install additional drivers. To use a given card, you simply insert it and go to work.

Unfortunately, lingering limitations of the PCMCIA standard will cause some frustration. For instance, though it fully sup-

ports the PCMCIA 2.1 standard, the CardShark will recognize only ATA drives formatted with the included SystemSoft formatting utility.

The CardSharkII (or one of several competitors you'll see in the next few months) should prove to be well worth the expense for those who have invested in PCMCIA storage devices or plan to. Adding a PCMCIA drive to your desktop



SLOT MACHINE: The CardSharkII provides PCMCIA compatibility.

PC is a great idea if you have the storage cards to go with it, and the CardSharkII is a good choice.

• List Price: *CardSharkII Model PCCS2-I (internal)*, \$299; *Model PCCS2-E (external)*, \$379. Requires: *DOS 5.0 or later*. *Curtis Inc.*, 418 West County Rd. D, St. Paul, MN 55112; 612-631-9512; fax, 612-631-9508.

Circle 423 on reader service card

If you've ever owned a copy of Norton Utilities[®], you know you don't need a super-hero's cape to have magic-like powers.

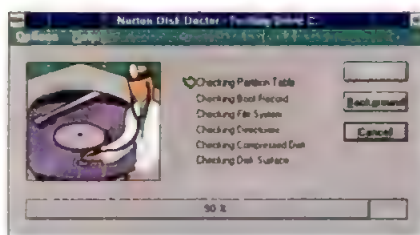
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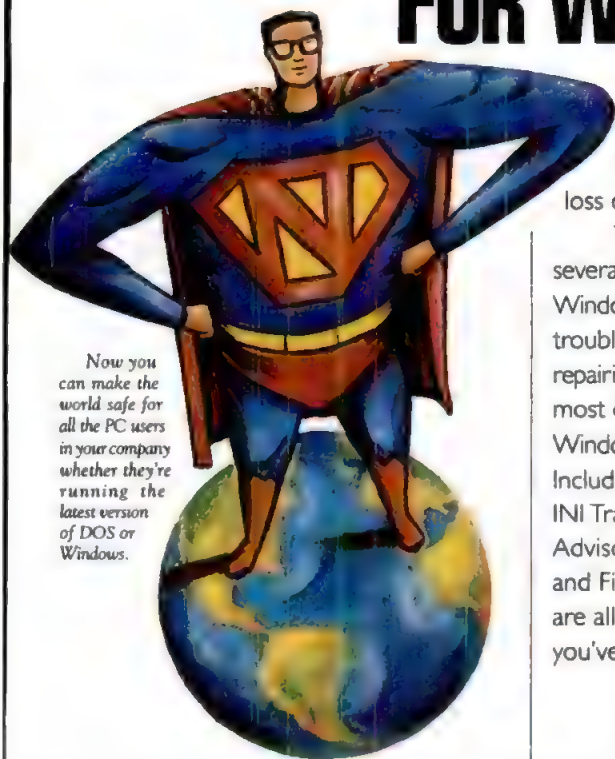


complete diagnostic tool set for analyzing all of your computer's hardware

components from drives to video.

There's also our new Interrupt Conflict testing to help eliminate conflicts and their subsequent lock-ups and to make it easier for you to

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potentially dangerous situations that could result in system failure and the loss of your data.

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install new devices on your system. It all adds up to a major upgrade. And if you are one of those

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■ Scheduling

PeopleScheduler Lays Out Smart Shifts

BY RICARDO DOBSON

Adaptive Software's \$495 Adaptive PeopleScheduler is designed for anyone who's responsible for scheduling workers on straight or split shifts. PeopleScheduler makes it easy to plan work schedules, to track overtime hours, and to adapt schedules to personal preferences or emergencies. You get virtually identical Windows and DOS versions in the same box.

The most impressive visual aspect of PeopleScheduler is its Scheduler Window. This screen shows time bars that graphically depict a worker's starting and ending times with breaks built-in. The table in Scheduler Window's lower portion links dynamically to the time bars. PeopleScheduler automatically develops worker schedules, including break times. You man-

ually adjust the program's finished schedules by graphically shrinking, stretching, or moving time bars around. You can also type different times directly into the table.

To make all this happen, PeopleScheduler needs to know about your business practices and your workers' preferences. In the Settings Window, you customize PeopleScheduler to your business by defining schedules, breaks, and overtime rules. In the People Window, you input data on each worker's availability and typical work schedule. Both the Settings Window and the People Window

contain tabs for quickly locating related settings.

PeopleScheduler generates reports based on any of 12 templates. A schedule report adds up paid hours worked by an employee on each day over a

Name	Work Group	Date	Start	End	Break	Hours	Rate	Total
Shari Fenn	Accounting	5/9	8:00a	5:00p	1:00p	8.0	\$4.50	\$36.00
Steve C. Carr	Sales	5/9	8:00a	4:00p	1:00p	7.0	\$4.50	\$31.50
Mike Peterson	Accounting	5/9	8:00a	4:00p	1:00p	7.0	\$4.50	\$31.50
Erving Ward	Accounting	5/9	8:00a	4:00p	1:00p	7.0	\$4.50	\$31.50
Jack Bradley	Accounting	5/9	8:00a	4:00p	1:00p	7.0	\$4.50	\$31.50
John S. Brown	Sales	5/9	8:00a	4:00p	1:00p	7.0	\$4.50	\$31.50
		5/9/94	Schedule 6		Total Hours		42.0	

PUNCH IN: PeopleScheduler gives you a visual approach to employee scheduling.

range of days. Other reports show things like employee break times, time away by employee

and date, and track record for lateness and sick time. You can customize PeopleScheduler reports by selectively choosing date ranges, schedule types, work groups, job titles, and individual employees.

There are a few things that PeopleScheduler isn't designed to do. It isn't connected to any electronic time-clock products or payroll services, so while it will help you schedule employees, it isn't intended to automate the payment process fully.

PeopleScheduler isn't the first employee scheduling program, but it's the one that's going to have the broadest appeal.

• List price: *Adaptive PeopleScheduler*, \$495. Requires: for DOS: 4MB RAM, 6MB hard disk space, DOS 3.3 or later; for Windows: 4MB RAM, 5MB hard disk space, Microsoft Windows 3.1. Adaptive Software Inc., 4000 MacArthur Blvd., #3000, Newport Beach, CA 92660; 714-851-1230; fax, 714-729-1556.

Circle 416 on reader service card

■ Utilities

Panoramic Has Unique File Viewers

BY BARRY SIMON

A robust collection of file viewers is a must for effective file management, but until now only The Norton Desktop for Windows, Outside In, and PC Tools for Windows have been able both to view a wide range of graphics files and to copy text from a word processing document that you're viewing into the Windows Clipboard.

Add to this group Cimmetry Systems' new \$129 Panoramic for Windows: a collection of viewers that can copy to the Clipboard, has strong file-conversion tools, and supports several new file types.

Panoramic links to Windows' File Manager via DDE (the specification is documented so

macro writers can also link other programs to the viewers). You can open a Panoramic window that displays files that you highlight in File Manager.



WIDE SUPPORT: Panoramic includes file viewers for three types of AutoCAD formats.

Panoramic provides viewing, printing, and conversion, but it doesn't have its own file management. So while you can use Panoramic to view files inside

compressed .ZIP files, you can't use it to copy those files to uncompressed files on disk.

Graphics viewing is especially strong in Panoramic. Bitmap viewers include not only the usual .BMP, .GIF, .ICO, .PCX, and TIFF formats, but also JPEG and .Targa. Vector viewing includes a PostScript viewer along with HPGL, .SLD, and several formats of interest to AutoCAD users: .DWG, .DXB and .DXF. None of Panoramic's competitors view .DWG, .DXB, or JPEG files. Only Outside In supports .Targa, and only PC Tools supports .DXF.

The viewer technology is extensible; Cimmetry Systems will continue to add additional viewers. As a matter of fact, during our testing, Cimmetry added

.CGM and .ICO support.

The 24-bit file viewers do no color reduction and therefore don't display properly on systems with 256 colors. Despite what the manual says, conversion is available only to bitmap types and not to vector types. Cimmetry Systems says it will address both issues soon.

For most users, a large utility collection that happens to include file viewers—such as The Norton Desktop for Windows or PC Tools—is still the best choice. But users with special file-viewing needs, especially for AutoCAD file formats, will want to give Panoramic a try.

• List price: *Panoramic for Windows, Version 1.1*, \$129. Requires: 2MB RAM, 7MB hard disk space, Microsoft Windows 3.x, DOS 3.1 or later. Cimmetry Systems Inc., 1430 Massachusetts Ave., #306, Cambridge, MA 02138; 800-361-1904, 514-735-3219; fax, 514-72935-6440.

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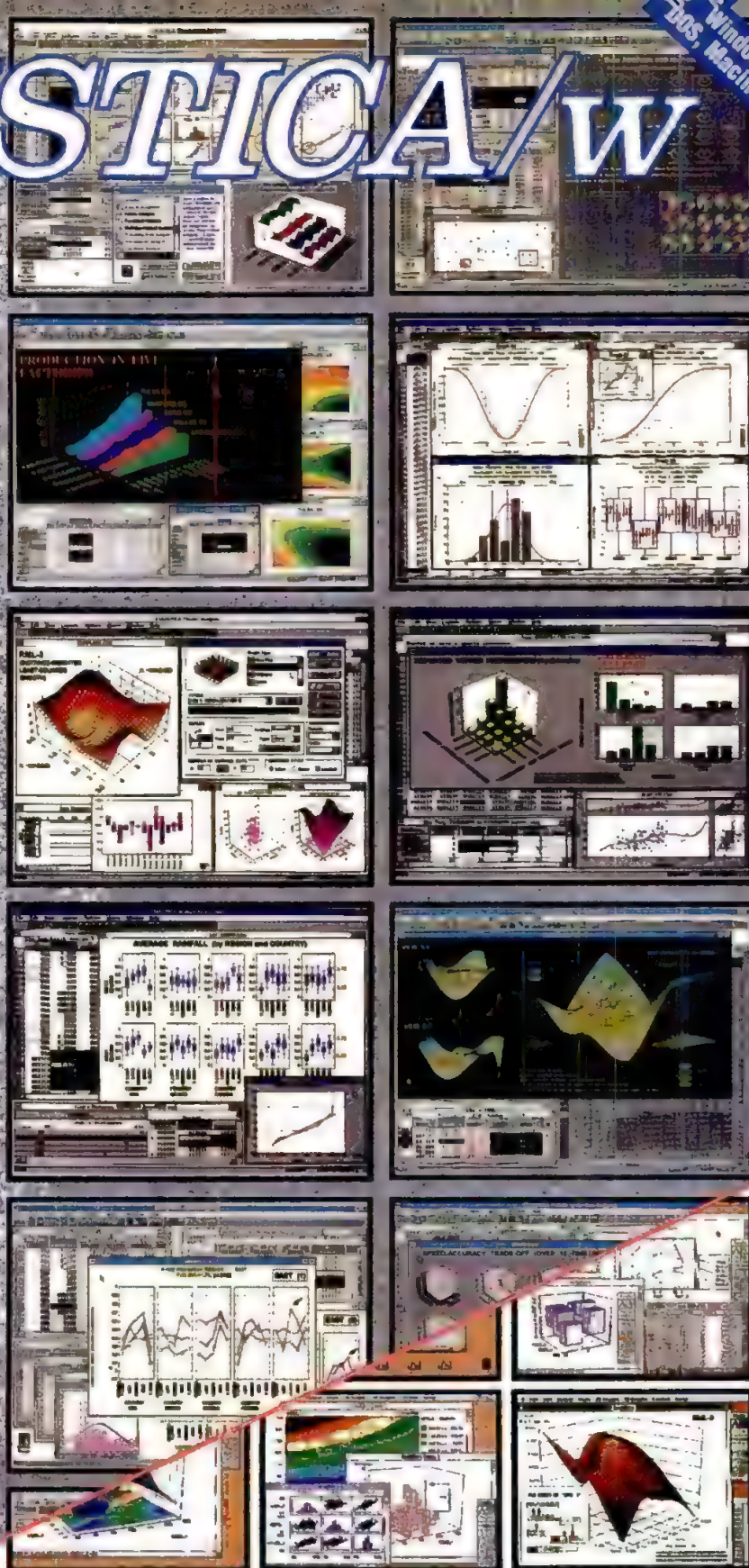
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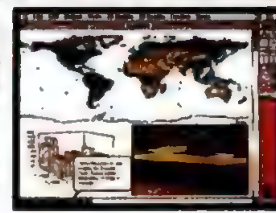
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STATISTICA/Mac™ (for Macintosh) A STATISTICA/w-compatible, comprehensive data analysis and graphics system designed for the Macintosh ■ Large selection of statistical methods fully integrated with presentation-quality graphics (incl. EDA, multiplots, a wide selection of interactively rotatable 3D graphs; MacDraw-style tools) ■ **Unlimited size of files** ■ **Full support for System 7, incl. "Publish and Subscribe"** ■ **Price \$695.**

Quick STATISTICA/Mac™ (for Macintosh) A subset of STATISTICA/Mac: a comprehensive selection of basic statistics and the full graphics capabilities of STATISTICA/Mac ■ **Price \$395.**



Dimensions (closed):
1.4" high x 11.1" wide
x 6.4" deep.

Weight: Less than
3 pounds; flash disk
model lighter.

Processor: 25-MHz
486SLC/e CPU.

Display: 640- x 480-dot
VGA; 9-inch LCD;
16-level grayscale.

Available PCMCIA

Type II slots:

Flash disk model: 2 slots.

Hard disk model: 1 slot.

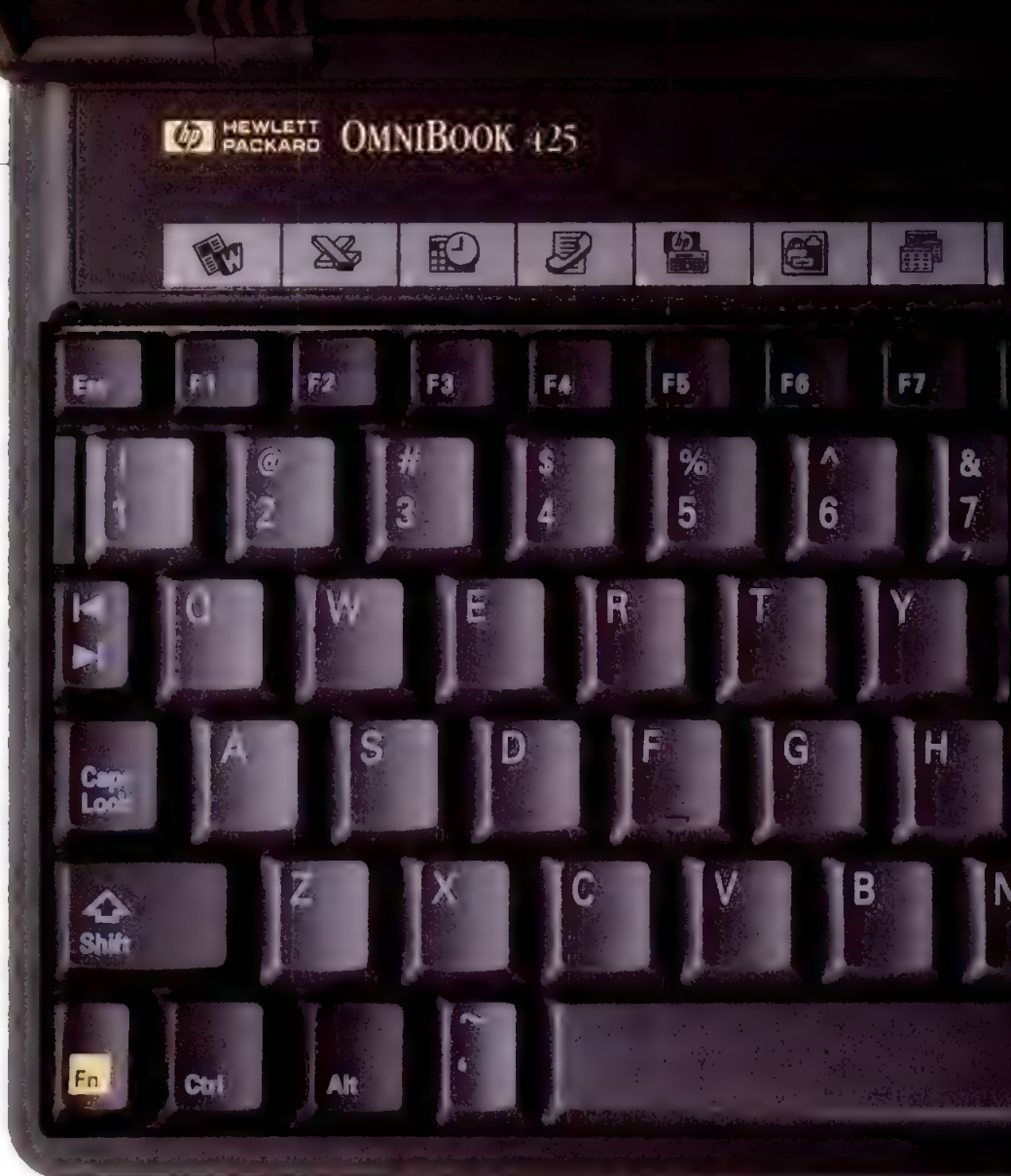
RAM:

2 MB expandable with
optional, user-installable
RAM expansion card.

I/O: 115K-baud serial
RS-232, serial infrared
and parallel. Optional
2400-baud data; 9600-
baud send/receive fax/
modem.

**Built-in applications
and more:** In addition
to applications built into
ROM, it is also an organ-
izer. An appointment
and address book. An
alarm clock. A calendar.
A calculator. A link with
the office PC. With
options, a fax and e-mail
terminal.

Actual size ►



Now, 486 technology

The new HP OmniBook 425 PC is the best thing going for people who travel on business. Because it's the lightest full-function PC with a full-size keyboard. And it's loaded with all the features busy travelers need to take with them.

We trimmed the weight (less than 3 pounds). But not the full-size keyboard. Measuring a sleek 1.4" x 11.1" x 6.4", the



HP OmniBook 425 won't slow business travelers down. And their fingers can move across those familiar keys just as fast as on their office PC. Because the keys are the same size.



With 8 hours of battery life, travelers can keep on going.

That's continuous use of the flash disk model. And the battery pack recharges in less than 1½ hours.

Or drop in four AA batteries. Even the hard disk model lasts 4½ hours between charges.

Microsoft® applications, built into ROM. Being built into ROM makes all the difference. It means Microsoft Word, Excel and Windows 3.1 come up instantly on the 9" LCD screen. No disk space is wasted. No time lost booting.



Or going in and out of applications. Instead, hit one function key and you're in business with your next application.

Built-in mouse saves space, works anywhere. Press a button. Out comes the mouse. It's not a ball or a stick. There's nothing extra to connect. It's a genuine mouse. And it pops up to make it as easy to handle as the ones people are used to working with. Which helps make working on the road as productive as in the office.

It turns on instantly in the same place it's turned off.

Although this superportable turns completely off to save battery life, it keeps track of the last screen. And that's where it turns on again. It doesn't even have to boot up.





"The OmniBook will become the truly hip walk-around computer of choice."

—Jim Seymour,
Columnist—PC Week,
PC Magazine

"Now HP stands for hot products."

—Business Week



is really going places.

The price to lighten your workload? The HP OmniBook 425 is just \$1,795 for the hard disk model; \$2,095 for the flash disk model. The HP OmniBook 430, starts at \$1,399.



For more information call 1-800-443-1254, Dept. 753. It's going to make a lot of workloads lighter. Including yours.

HP OmniBook.

Personal Convenience. Personal Power.



AREAS OF DOMINANT INFLUENCE



MicroScan 2E

- 14-inch (13.5V) 0.28dp
- 800x600NI, 640x480@72Hz
- Energy Star (EPA) Compliance



MicroScan 3E

- 14-inch (13.5V) 0.28dp
- 1024x768NI, 800x600@72Hz
- Swedish MPRII (optional)
- Energy Star (EPA) Compliance



MicroScan 3GP

- 14-inch (13.5V) 0.28dp
- 1280x1024NI, 1024x768@76Hz
- WYSWYG Color Matching
- Swedish MPRII
- Energy Star (EPA) Compliance and Nutek/TCO Compliance



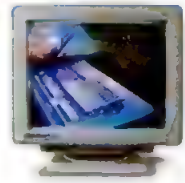
MicroScan 4GP

- 15-inch (13.8V) FST 0.28dp
- 1280x1024NI, 1024x768@76Hz
- WYSWYG Color Matching
- Swedish MPRII
- Energy Star (EPA) Compliance and Nutek/TCO Compliance



MicroScan 5EP

- 17-inch (15.8V) FST 0.28dp
- 1280x1024NI, 1024x768@76Hz
- WYSWYG Color Matching
- Swedish MPRII
- Energy Star (EPA) Compliance and Nutek/TCO Compliance



MicroScan 5AP

- 17-inch (15.8V) FST 0.26dp
- 1280x1024NI, 1024x768@76Hz
- WYSWYG Color Matching
- Swedish MPRII
- Energy Star (EPA) Compliance and Nutek/TCO Compliance



March 16, 1993
ADI MicroScan 3E+



- ★★★★ 8.0 ADI MicroScan 4GP
- ★★★ 7.7 MAG MX 15F
- ★★★ 7.5 Viewsonic 15
- ★★★ 7.5 CTX CPS 1560LR
- ★★★ 7.2 NEC 4FGe



Here's why ADI Monitors are Dominant



Microprocessor Intelligence

Analyses and remembers size, centering, and geometrical adjustments for the different video modes you work with.



Fingertip Front Panel Controls

Can be used to individually adjust and customize each display mode for display size, centering, and geometrical distortions.



Controls Pincushion and Barrel Distortions

Pincushioning alters the shape of on-screen images, making them appear concave. Barrel distortion is the inverse of pincushioning. Instead of curving in, the on-screen image bows out, resembling a barrel.



Vertical Linearity

If the horizontal bars appear to be crowded at the top or the bottom (using Windows Excel), the vertical linearity control may be used to correct such symptoms.



Vertical S-Correction

If the horizontal bars appear to be crowded near the center but are of equal spacing at the top and bottom, the vertical S-correction control may be used to adjust such symptoms.



WYSWYG Color Matching

Allows you to work with colors you expect to see in your finished print-out.



Non-interlaced Image Scanning

At any given resolution, non-interlaced scanning reduces screen flicker.

"For the best balance of quality and features..."

Byte Magazine, Jan. 1994

The new industry standard for compatibility, versatility, and reliability - a breakthrough in modern monitor technology ... from ADI.

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CIRCLE 228 ON READER SERVICE CARD

New & Improved

NEWS OF ANNOUNCED PRODUCTS AND UPGRADES

By Adam A. Hicks

IMPROVED

Calendar Creator 2 Lets You Get Really Creative

Spinnaker Software Corp. no longer exists due to a merger with **Softkey International**. Calendar Creator Plus for Windows, however, is still around—now in Version 2 with features that let you enhance any calendar you create with photos and unique layouts.

Support for full page photos, seven predefined calendar styles, and a clip-art/photo manager make customizing your layouts simple and quick. You can visually enhance your schedules with color, graphics, fonts, and banners, and then print in a variety of styles (daily to yearly) on paper sizes ranging from credit card-size pocket diaries to 8.5- by 11-inch calendars in either color or black and white.

- List price: *Calendar Creator Plus for Windows, Version 2*, \$69. **Softkey International Inc.**, 201 Broadway, Cambridge, MA 02139; 800-826-0706, 617-494-1200; fax, 617-494-1219.

Circle 403 on reader service card.

IMPROVED

No-Hassle Wireless Links for IBM ThinkPads

Complete plug-and-play for all PCs, notebooks, and peripherals may not be a reality yet, but **RadioMail Corp.** has earned the IBM "ThinkPad Proven" label for its RadioMail Remote for DOS. If you're looking for a wireless messaging solution for your IBM ThinkPad you may want to consider this package, which includes DOS-based software, an RF modem (either a Motorola InfoTAC or Ericsson GE Mobidem), and a serial connector to the ThinkPad. To pique your interest, RadioMail is waiving the \$99 new-user initiation fee.

Once connected, you can access all aspects of the RAM Mobile Data and ARDIS RF networks to send messages to public and private mail services, such as MCI Mail and the Internet.

- List price: *RadioMail Remote for DOS package*, \$850. **IBM PC Co.**, Route 100, Somers, NY 10589; 800-772-2227.

Circle 404 on reader service card.

HOT PROSPECT



On-Line Investment Wisdom For Quicken Users

If you use Quicken to manage your money, **Reality Inc.**'s Reuters Money Network for Quicken will automatically link your portfolio to market data and news stories that effect your investment choices. You use the Windows-based software to download almost everything an average or even not-so-average investor would need, including current stock quotes from all the major markets and research databases that cover stocks, bonds, mutual funds, CDs, and money markets. More importantly, you can analyze your choices with historical pricing charts and performance graphs, or even compare them with other options using information from Standard & Poor's and Morningstar. There's also a clipping service that creates a 4-page newspaper with sources such as *The Wall Street Journal*, CNBC, and Dow Jones News Service. By summer, you'll also be able to do on-line trading through discount brokers. Monthly connection charges will range from \$9.50 to \$24.90 depending on the type of service. If you're not a Quicken user, Reality will be shipping a Windows version of their own financial management package with identical on-line connections this summer.

- List price: *Reuters Money Network for Quicken Users*, \$24.95 (on-line charges extra). **Reality Technologies Inc.**, 2200 Renaissance Blvd., King of Prussia, PA 19406-2755; 800-346-2024, 215-277-7600; fax, 215-278-6115.

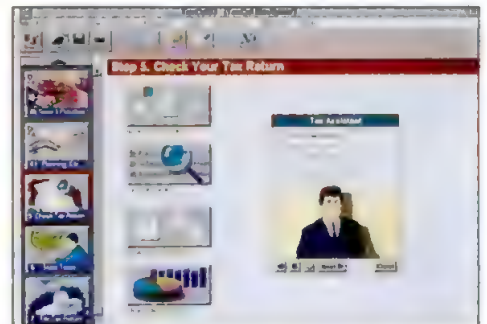
Circle 402 on reader service card.

NEW

Walking, Talking Tax Forms From MECA

If you haven't finished your taxes yet or are trying to think of ways to make next year a more interesting experience, **MECA Software**, makers of TaxCut, have created a CD-ROM version of their tax-planning software called TaxCut Multimedia.

By using multimedia you get a verbal and written explanation of the forms' questions and appropriate responses, as well as video clips of Harvard Law School graduate Dan Caine discussing specific topics and tax issues. And because CDs store so much data, MECA can provide the full text of IRS instructions, searchable by topic or type of form.



TaxCut Multimedia personal assistant talks.

The CD version uses the same user interface found on the floppy disk-based package. The interface is called The Navigator because it walks you through the tax process step-by-step. The multimedia release is fully compatible with TaxCut Headstart and all 23 state editions of the TaxCut program. Other import options include files from Kiplinger's CA-Simply Money, Managing Your Money, Microsoft Money, Quicken, TurboTax, or any program with .TXF format support.

Multimedia means certain system requirements, and TaxCut Multimedia requires a 386 or better processor (486 recommended), Microsoft Windows 3.1, 4MB of RAM, a VGA monitor, a CD-ROM drive, a sound card, and speakers.

- List price: *TaxCut Multimedia*, \$89.95. **MECA Software Inc.**, 55 Wall Dr. Fairfield, CT 06430-0912; 800-820-7461, ext. 446; 203-256-5000; fax, 203-255-6300.

Circle 405 on reader service card.

New & Improved

NEW AND IMPROVED

High and Low Roads to Windows-Based Project Management

Primavera Systems' Project Planner for Windows is intended for the professional project manager who needs to track, display, and analyze large-scale projects in minute detail. Optimized for enterprise-wide project planning, the new Windows version makes comparing multiple layouts of charts and diagrams easier. Object linking lets you cut and paste information between multiple projects. Even with its friendlier Windows interface, though, this serious package is not for those who are completely unfamiliar with project management.

In contrast, Microsoft Project 4.0, from **Microsoft Corp.**, will help you get a handle on departmental or team-type projects, even if you have little knowledge of project management. Numerous improvements focus on ease of use and data presentation.

Highlights include the ability to add text onto the many different calendar views or Gantt charts and improved printing options. Projects that would normally print with many blank pages are now shrunk to fit on fewer pages while still providing relevant information. The software also provides you with Microsoft aids such as cue cards, "Wizards," and tabbed dialog boxes to assist you in creating appropriate connections among your tasks. The package also has e-mail routing lists and can incorporate time sheets and status reports automatically.

- List price: *Primavera Project Planner for Windows*, \$4,000. **Primavera Systems Inc.**, Two Bala Plaza, Bala Cynwyd, PA 19004; 800-423-0245, 215-667-8600; fax, 215-667-7894. Circle 406 on reader service card.

- List price: *Microsoft Project, Version 4.0*, \$695 (upgrade from Version 3.0, \$149). **Microsoft Corp.**, One Microsoft Way, Redmond, WA 98052-6399; 800-227-4679, 206-882-8080; fax, 206-936-7329.

Circle 407 on reader service card.

NEW

AutoCAD Heads for the Third Dimension

Three-dimensional modeling just got easier. AutoCAD Designer, **Autodesk Inc.**'s new product, gives users of AutoCAD, Release 12, the high-end functionality of parametric solid modeling at a more affordable price. You can create objects with bidirectional associations

BRIEFS

Graphics Accelerators

Media Vision is shipping the Pro Graphics 1024 Windows accelerator. The card supports 16.7 million colors at resolutions up to 1,024-by-768 in either VGA or Super VGA modes and uses custom accelerator chips. The VESA local bus is available in two versions: the True Color version (\$595) or the 256-color version (\$395). 800-348-7116, 510-770-8600.

VidTech Microsystem's GraphMax P12 is based on IBM XGA architecture and has a VGA core processor and graphics coprocessor. The card comes standard with 1MB of VRAM (upgradable to 2MB) and supports 16.7 million colors at 800-by-600. It's priced at \$399 with 1MB of VRAM and \$489 with 2MB. 800-752-8033, 612-780-8033.

STB Systems Inc. (800-234-4334) floods the market with three new 32-bit boards and one new 64-bit board.

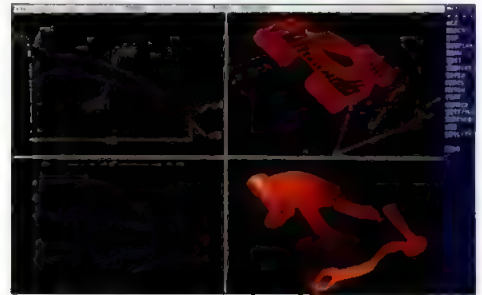
Their flagship board, Lightspeed, is now available in PCI or VLB versions, standard with 2MB DRAM for \$289. This board is based on Tseng Labs W32P controller chip and will give you 256 colors at 1,280-by-1,024 at a 70-Hz refresh rate.

Alternatively, there are the lower priced Express PCI (\$169) and Sprint VL (\$149) for PCI and VESA Local Bus boards respectively. Each holds a maximum of 1MB DRAM and have similar performance with 256 colors at 1,024-by-768 resolution and a 72-Hz refresh rate.

For 64-bit you'd go with the \$249 Nitro. This PCI 2.0-compliant board is based on Cirrus Logic 5434 controller and is loaded with up to 2MB DRAM. You'll be able to do 16.7 million colors at a resolution of 800-by-600 at 60 Hz or go for 1,024-by-768 resolution with 65K colors at 72 Hz. A 1MB version is priced at \$179.

Kelvin 64 is the latest 64-bit graphics accelerator from **Orchid Technology** (800-767-2443) and is available in either ISA, PCI, or VLB configurations. The Kelvin 64 supports VESA refresh rates and complies with the Green PC specifications. The board ships with 1MB DRAM which will give you 16 colors at 1,280-by-1,024 or 16.8 million colors at

and then display detailed multiple-view drawings, including isometric and orthographic views. The package lets you sketch basic relationships for an object first and then go on to define such things as parallelism, co-linearity,



New de 3-D modeling with AutoCAD Designer.

and horizontal or vertical leveling.

Moreover, when you edit the features of an object, the changes—including mass property information changes—automatically transfer. AutoCAD Designer runs as an add-on to AutoCAD, Release 12, and is compatible with other AutoCAD software rendering and shading products such as the recently released AutoSurf, Version 2.0.

- List price: *AutoCAD Designer*, \$1,500. **Autodesk Inc.**, 2320 Marinship Way, Sausalito, CA 94965; 800-964-6432, 415-332-2344.

Circle 408 on reader service card.

IMPROVED

Flexible, Simple Label Making From Softkey

Softkey International's Labels Unlimited for Windows has more going for it than simply the number of different label types it can print on. The Windows version of the package has 350 templates (including floppy disk, shipping, and video or audio cassette labels), which you can modify with clip art or company logos and then print in color or black and white.

The package supports all TrueType and Adobe fonts and even rotated text, and it will print watermark imaging and bar codes. Also improved are the program's layout tools. You will find WYSIWIG viewing, snap-to guidelines and grid locks, layout rulers (now with metric support), and drawing tools (including fill patterns). The database now supports dBASE files and allows you to search on up to six fields (but you can sort only on three).

- List price: *Labels Unlimited for Windows*, \$79.95. **Softkey International Inc.**, 201 Broadway, Cambridge, MA 02139; 800-826-0706, 617-494-1200; fax, 617-494-1219.

Circle 409 on reader service card.

Pixels per second

1,600,000

1,400,000

1,200,000

1,000,000

800,000

600,000

400,000

200,000



WinBench scores
(average of 10 runs):
Close-Up 1,613,118
pcAnywhere 194,093
Carbon Copy 168,397

WinBench™ 3.11 by Ziff-Davis Labs Tests Remote Windows™ Speed

This graph shows the speed of the three leading remote control programs when transferring Windows screens. As you can see, Close-Up handles more pixels, faster, meaning you spend less time waiting for Windows screens.

The industry standard test, WinBench 3.11, is perfect for testing the speed of remotes. It is an accurate measure of video throughput. Video throughput is the limiting factor in remote operations, because remote programs must transmit Windows video functions from one PC to the other.



New Remote Software Sets Windows Speed Record

Communicate Faster & Easier

Close-Up® lets you communicate faster & easier with five exciting technology firsts.

Close-Up is the only remote communications software that won both PC Magazine's coveted "Editors Choice" and PC World's "Best Buy" awards. Now Close-Up has a new faster & easier version that allows you to view and control another PC by modem as if you were there!

Technology Firsts

1. AI Video Compression
2. Photographic Memory
3. Non-Intrusive Technology
4. Expert System
5. Video Translation

Why Is Close-Up So Fast?

Close-Up learns as it works. It uses AI (Artificial Intelligence) to compress all Windows video function calls. That's why Close-Up does so well in Windows

Benchmark tests (see WinBench 3.11 chart). Close-Up uses its revolutionary Photographic Memory™ so that once Close-Up has seen all or part of a Windows screen, it's memorized. Then as screens change, Close-Up only transmits new unmemorized data. Incredibly, with this technology Close-Up gets faster & faster the longer you use it.

What Remote Companies Haven't Told You

Other remote programs permanently slow Windows and usually reduce your video resolution and depth of color, even when they are not in memory. That's because they permanently change your system.ini file. Close-Up's breakthrough Non-Intrusive Technology does not modify any of your sensitive Windows files including the system.ini. Close-Up is the only remote that when not in use, allows Windows and your PC to run at normal optimal levels.

Expert System Makes Communications Easy

You don't have to be a communications expert to get the results of one. Close-Up has an Expert System that automatically analyzes system components and configures your system for optimal speed.

Video Translation

With Close-Up, dissimilar PCs can easily connect, because Close-Up senses the video capabilities of both PCs and automatically displays Windows in a video mode compatible with both sides.

Risk-Free Offer!

Try Close-Up. If you're not absolutely convinced that Close-Up 5.0 is the fastest remote program, we'll give you your money back!® Order Close-Up Host & Remote, a complete system, for only \$199.95

Upgrade your current or competitive remote program to new Close-Up 5.0. Get both sides, Host & Remote, for only \$69.95

Order Today 805-964-6767

Norton-Lambert

We invite you to reproduce this test. We used two identical Gateway 4DX2-66V's with 66-MHz Intel 486DX2-66 CPUs, 16 MB RAM, 256KB RAM cache, 340 MB HD, IDE controller, no hardware disk cache. Video: Local Bus ATI Ultra Pro with 2MB VRAM, 640 by 480 pixels, 16 colors, VGA.DRV dated 3/10/92. Monitor 72 Hz. MS-DOS 5.0, SMARTDRV 2 MB cache. Modem: two 14,400 baud V.32bis. Test performed without verification by Ziff. All products are shipping versions. WinBench trademark of Ziff Communications Co. Windows trademark of Microsoft Corp.

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Introducing Omni Precisely what you'd expect

The world's most advanced OCR.

If OmniPage® Professional broke the mold for OCR, then OmniPage Professional 5.0 promises to be nothing short of revolutionary. Professional 5.0 represents the biggest technological breakthroughs ever pioneered by Caere. Advancements that push our level of OCR accuracy to new heights. Increase ease of use and flexibility. And expand feature capabilities beyond any previously offered. Now at a price you can afford.

Recognize more.

For the first time in the history of OCR, you can now get full page retention of any document—even those with text and images—without losing the document's original format. It's made possible with Professional 5.0's True Page™ which offers true page-based display and access capabilities. So what you see on the printed

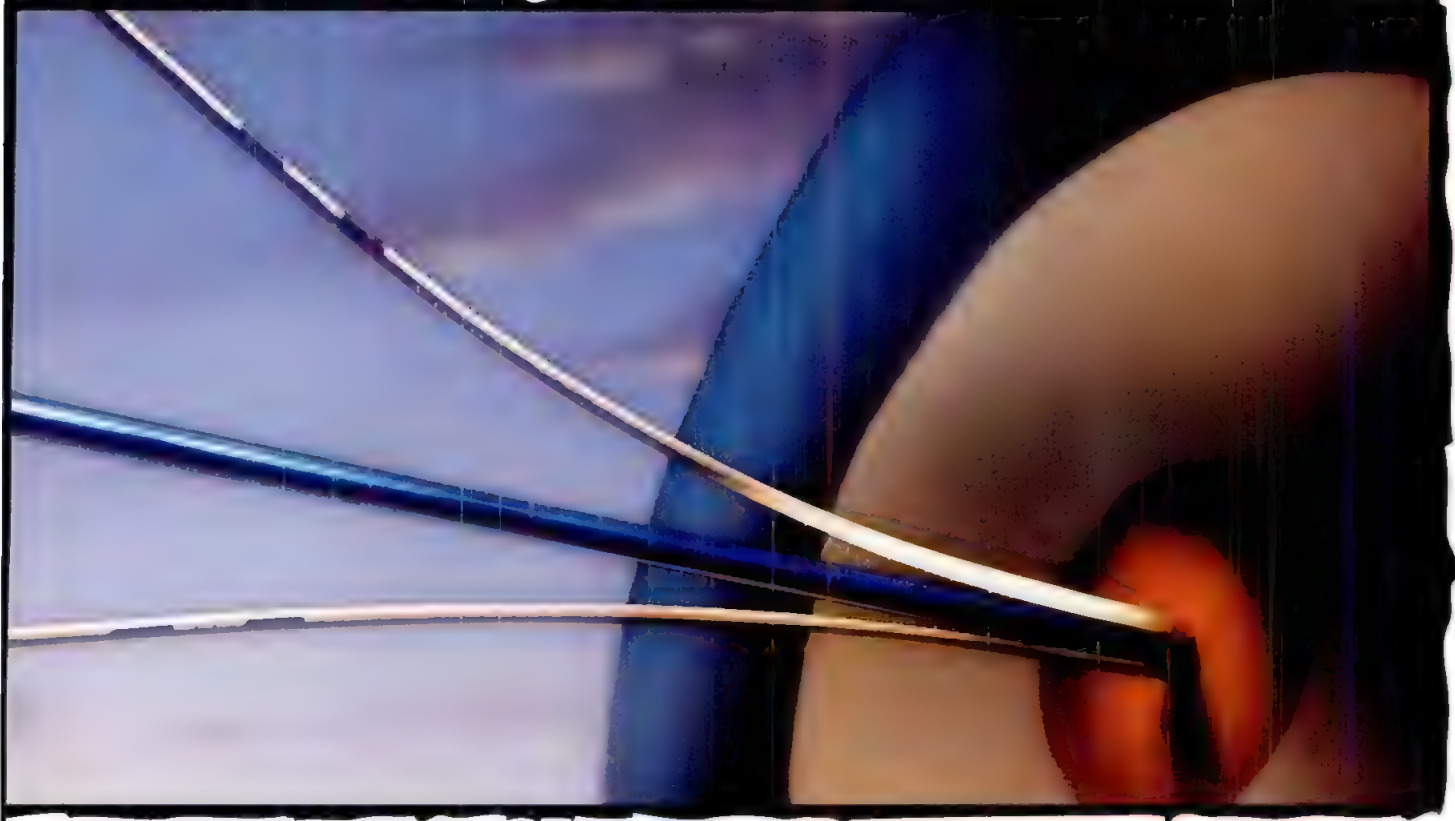
page is what you'll see after your document is recognized. What's more, you'll have immediate access to your data and images. Use the new WYSIWYG Text Editor to easily edit and manipulate text. Or enhance images with an integrated 24-bit color image editor. It's never been easier to recognize, proof, or modify a printed document.

Get more accomplished.

In the past, OCR users had to follow a rigid and often time-consuming sequence of steps to scan, recognize, and save a document. Now with Professional 5.0's Dynamic Access Panel™ you can work in a style that's convenient for you. The panel's intuitive interface is designed for maximum workflow flexibility. The click-and-choose functionality allows you to modify your workflow, even in the middle of a job. Professional 5.0 also allows you to save and customize zone templates to use with similar documents in the future. And its improved training capabilities mean you can "teach" it to recognize



For Your Information.



Page Professional 5.0. Next from the leader in OCR.

more custom characters than ever before. In addition, Professional 5.0 contains all the easy-to-use features you've come to expect from the leader in OCR, including:

- Custom character recognition
- Deferred processing
- 24-bit color image editor
- Recognition of 11 languages
- Scans fonts from 6-72 points
- TWAIN support
- HP AccuPage™ technology 2.0 support

Redefining OCR Accuracy

Professional 5.0's advanced accuracy is made possible by Caere's recent technological breakthroughs. To begin with, Caere has taken its award winning OCR to a new level with 3D OCR.

3D OCR is a revolutionary technology that uses full gray images for the first time. Professional 5.0 is able to view the "depth" of each character pixel, so it can be used as additional "data" in the recognition

process. OmniPage also includes a new compound neural network to help with extra tough pages like faxes. In addition, Professional 5.0 features the Language Analyst™, a sophisticated language checker which eliminates many OCR errors.

So whether your documents contain a challenging layout, images, or low resolutions, you can count on Professional 5.0 to give you precisely what you're looking for.

To get your copy of OmniPage Professional 5.0, or learn about the new OmniPage 5.0 or OmniPage Direct, see your local Caere dealer or call us for more information at 1-800-535-SCAN.

omniPAGE
PROFESSIONAL



CIRCLE 097 ON READER SERVICE CARD

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IMPROVED

Curtain Goes Up On ACT! 2.0

ACT! for Windows recently received an Editors' Choice award ("Contact Management: Keeping in Touch," August, 1993), and now, **Symantec Corp.** has enhanced Version 2.0 with networking and integrated e-mail capabilities. You can share a common database over NetWare 2.11 or later, Artisoft LANtastic 5.0, or Microsoft Windows for Workgroups while retaining the ability to create subgroups and private groups of contacts. Network administrators can use passwords with the Supervisor Utility to manage various levels of rights and security. Within the program, you can create and send e-mail over multiple mail systems such as Lotus's cc:Mail, Microsoft Mail, and CompuServe (all from a single integrated mailing list). New printing and sorting options include support for additional types and sizes of organizers, international address formats, and sorting on company or last name fields.

• List price: *ACT! for Windows, Version 2.0*, \$399. Symantec Corp., 10201 Torre Ave., Cupertino, CA 95014-2132; 800-441-7234, 408-253-9600; fax, 408-252-4694.

Circle 410 on reader service card.

IMPROVED

WinFax PRO 4.0 Focuses on Faster Faxing

WinFax PRO 4.0 shows that **Delrina Corp.** wants to stay on top of the fax software market not only by adding more features but by making them easier to use. You can customize the interface simply by dragging column edges to resize or reorder them on the screen, and you can manage documents by dragging and dropping them into folders by characteristic (such as date and time) or with a thumbnail of the fax attached. Other tweaks include a quick cover-page option, increased fax viewing speed, and better OCR performance. You'll also find support for mobile users (such as auto-forwarding, extended dialing sequences, and the ability to retrieve faxes from a remote connection) and enhanced messaging functionality (error correction, VIM and MAPI support, and compliance with fax transmission protocols).

The program requires a 286 processor or better, Microsoft Windows 3.1, 4MB of RAM, and 10MB of hard disk space.

• List price: *WinFax PRO 4.0*, \$129. Delrina Corp., 6830 Via Del Oro, #240, San Jose, CA 95119; 800-268-6082, 408-363-2345; fax, 408-363-2340.

Circle 411 on reader service card.

BRIEFS

640-by-480. An upgrade to 2MB DRAM will increase the performance to 16.8 million at 800-by-600 or 65K at 1,024-by-768. All three versions are priced at \$250 for the 1MB version and \$325 for the 2MB version.

PCMCIA

If you want to use a PCMCIA peripheral on your desktop PC, **Acma Computer's** CARDrive will help. It looks like a regular disk drive, but with the system software loaded it will accept up to two Type I, II, or III cards or a single type IV card with full PCMCIA 2.x compliance. It's priced at \$199. 800-456-1818, 510-623-1212.

The new Gold Series of PCMCIA modems from **Megahertz Corp.** is available with or without Megahertz's famous retractable XJack connector, but both new modems have flash ROM to make the firmware easily upgradable and support the MNP 10 protocol to tackle tough communications. The modems are priced at \$399 with or without the XJack. 800-527-8677, 801-320-7000.

Hardware

Micropolis Corp.'s Storage Systems Division has shipped the Model 4110 Taurus disk drive. The drive has a 1-inch-high form factor, a SCSI-2 interface, and a formatted capacity of 1 gigabyte. The Taurus has an average seek time of 8.5 ms (with a maximum seek time of 20 ms), yet it consumes less than 9 watts of power. It's priced at \$1,325. 818-709-3300.

Olympus Image Systems Inc. has introduced two new printers in its Deltis line, the Deltis PagePlex 18 and the Deltis PagePlex 24. Both are optimized for multiplatform environments. The 18 page-per-minute model costs \$3,895 and for the 24-ppm model is \$6,295. 800-347-4027, 714-753-5935.

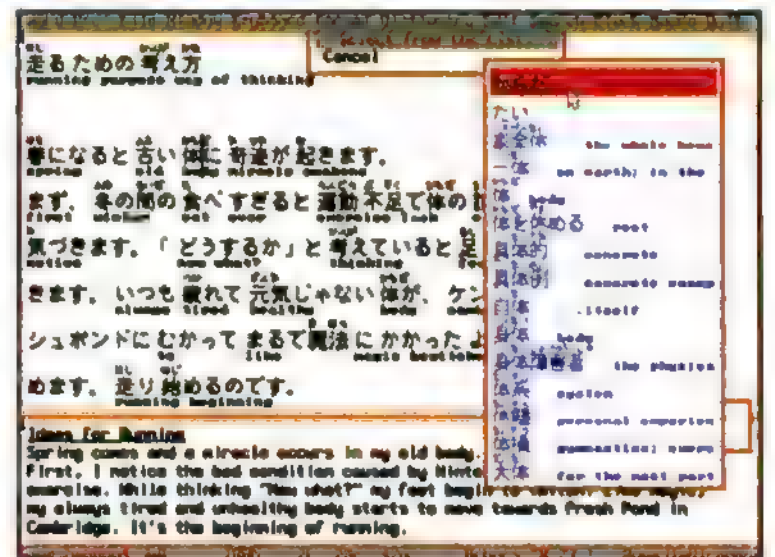
Home Computing

The Association of Shareware Professionals has put out a CD-ROM containing 1,000 DOS and Windows shareware programs for you to browse through. There are entertainment, education, and personal productivity programs and plenty of games, too. If you

NEW

Smart Characters Brings Kanji Characters to Your Keyboard

Apropos Inc. has developed Smart Characters for Students, Version 2.9, a translating word processor and teaching tool that understands 7,700 Kanji characters (both Japanese and Chinese style). Enter words in Chinese characters and you will automatically receive their character representation, pronunciation (either fuigana, pinyin or bopomofo) and an English translation. Alternatively, type in English to get a roughly interpreted presentation in Kanji characters and pronunciation. In addition to its bilingual composing abilities, Smart Characters also contains teaching tools. Character flash cards monitor your correct responses and recall time or, of you want a more leisurely procedure, you can query the



Smart Characters teaches or translates Kanji.

Chinese character dictionary in order to get the translation of the character and see an illustration of how it is used.

• List price: *Smart Characters for Students, Version 2.9*, \$99. Apropos Inc., 8 Belknap St., Arlington, MA 02174; 800-676-4021, 617-648-2041.

Circle 412 on reader service card.

NEW

Visio Express, the First Add-On For Microsoft Office

Shapeware Corp.'s simple-to-use drawing package, Visio 2.0, has been modified to act as a built-in component of the Microsoft Office integrated software suite. With Visio Express, you can create business graphics such as flowcharts, time lines, and block diagrams while running other Microsoft Office applications, such as Excel or Word for Windows. The secret to its success is full OLE 2.0 compliance. The graphics that you create become a part of the document that you are working on and don't

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At the corporate network

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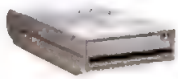
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- Up to 18 MB/minute backup speed
- Includes software and more
- Optional Cheyenne ARCserve for PowerTape*

At the workgroup network

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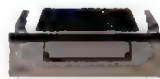
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Jumbo 120



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- Up to 4.7 MB/minute backup speed
- Includes software and more

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- Includes software and more

Jumbo Trakker 120



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require Visio to be viewed later.

• List price: *Visio Express for Microsoft Office*, \$79. *Shapeware Corp.*, 520 Pike St., #1800, Seattle, WA 98101-4001; 800-446-3335, 206-521-4500; fax, 206-521-4501.

Circle 413 on reader service card

NEW

Nine Modules Start Off Solomon IV Windows Accounting

Solomon Software's Solomon III has been replaced by a Windows version written entirely in Visual Basic. Solomon IV will have 20 modules by the end of the year, but only 9 are now shipping. The first modules include the System Manager (required to run other modules), General Ledger, Order Processing, Inventory Management, and R&R SQL Report Writer. The open architecture design lets you modify screen objects and create scripts using Basic to introduce event driven logic to your business' accounting practices.

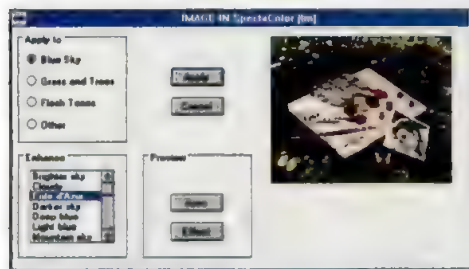
• List price: *Solomon IV for Windows*, \$1,295 per module for 6-user license, \$10,995 per module for 100-user license. *Solomon Software*, 1218 Commerce Pkwy., P.O. Box 414, Findlay, OH 45840; 800-879-0444, 419-424-0422; fax, 419-424-3400.

Circle 414 on reader service card

IMPROVED

FotoTune LE Added to Image-In

CPI Inc.'s Version 3.2 of Image-In Power Pack and Image-In Professional Pack now have Agfa's FotoTune LE and graphics tools built in. FotoTune LE is a color-management system from Agfa that "colortags" scans in order to retain the truest quality during pro-



The SpectraColor utility enhances color quality.

cessing. This technology matches the color producing intricacies of the output with those of the output hardware, so even if the colors don't look great on-screen, they'll be as close to true color as possible when they are output. Similarly, a DPI meter called ScanAssist automatically determines the exact optimum scan

BRIEFS

like a program, you send the shareware fee directly to the appropriate person. The disk itself costs \$24.95 (plus \$2 shipping), with proceeds going to the ASP. 616-788-5131.

Expert Software has released a \$14.95 way to look at the stars. The package, *Expert Astronomer for Windows*, will make both novice and advanced astronomers feel at home. It contains more than 10,000 astrological sights such as stars, planets, galaxies, comets, and constellations. You can view the stars as they'd appear from any part of the sky and print out maps to help you locate them in the sky. 800-759-2562, 305-567-9990.

CD-ROM is a natural step for **Personal Training Systems** to release their instructional software on. Formerly you'd listen to a tape and follow the instructions on software. Now, you listen to instructions from the CD and follow using a single package, skipping from lesson to lesson. Available for many popular programs, each disk is priced at \$159.95 and includes beginning, intermediate, and advanced lessons. 415-462-2100.

And Finally . . .

More digital literature is right around the corner as **World Library Inc.**, a leading CD-ROM publisher of classic literature, has entered a licensing agreement with **McGraw-Hill**. **3M** wants a 25GB standard for 5.25-inch tape drives, but that probably won't happen until 1995. Meanwhile, we'll have to settle for 13GB. **ABCD: The Microcomputer Industry Association** has formed a Parts Task Force to address the problem of spare parts for the PC industry. If you're a "self maintainer"—one of those people who replace things instead of throwing them out—and you don't know about **PC Parts Express**, you may want to give them a call at 800-727-2787. **Omega Corp.** has dropped suggested retail prices on some Bernoulli drive products by 29 percent. **Anderson Soft-Tech**, 800-338-4336, has created a \$995 three volume video course to teach computer literacy that gives a basic introduction about what a PC is and what it does.

resolution without your interference. Other tools include a Copier function, for simple one-touch scan and print; and PhotoLens, to overlay true professional photographic lenses and filters over images to create any mood or effect.

• List price: *Image-In Power Pack 3.2*, \$495; *Image-In Professional Pack 3.2*, \$795. *CPI Inc.*, 1953 Landings Drive, Mountain View, CA 94043; 800-345-3540, 415-961-6456; fax, 415-961-6465.

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NEW

Multiple Multimedia Machines Made Affordable by Acer

Acer America Corp. has released five new PCs ranging from a 33-MHz 486SX to a 60-MHz Pentium, and all of them have the basics for sound, graphics, and text to come together.

Three models are in the Acer Acros 4000 family, a value line targeted at the home market, and are now available with accelerated local-bus video, 4MB of RAM (expandable to 36MB), a double-speed CD-ROM drive, a 16-bit Sound Blaster-compatible sound card, a 9,600/4,800-bps fax/modem, external speakers, and a Pentium OverDrive socket. Preinstalled software includes 12 different packages, with multimedia titles from Microsoft, Intuit's Quicken for Windows, America Online, Prodigy, and Phoenix MicroFax.

Two new mini-tower models feature a unique clamshell design. To get at the guts of the systems, the entire side of the mini-tower pivots down to the floor, where all the essential components are easily accessible. The AcerPower 8681TG uses a 66-MHz 486DX2, has a local-bus graphics accelerator (leaving one local-bus expansion slot open), and comes with 4MB of RAM (expandable to 64MB). This mini-tower comes with all the same software and hardware as the 4000 series does. The AcerPower 9897TG, a member of Acer's Pentium family, has PCI local bus expansion, an ATI PCI graphics card, a 256K cache, 8MB of RAM (expandable to 96MB), a 540MB hard disk, and almost all the same hardware and software options. The 9897TG doesn't come with a modem, so you won't need America Online, Phoenix MicroFax, or Prodigy software.

• Estimated street prices: *Acer Acros 4221G*, \$1,199; *Acer Acros 4471G*, \$1,499; *Acer Acros 4581G*, \$1,699; *AcerPower 8681TG*, \$1,999; *AcerPower 9697TG*, \$2,799. *Acer America Corp.*, 2641 Orchard Pkwy., San Jose, CA 95134; 800-733-2237, 408-432-6200; fax, 408-922-2953.

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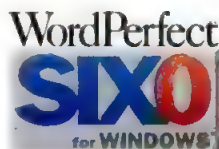
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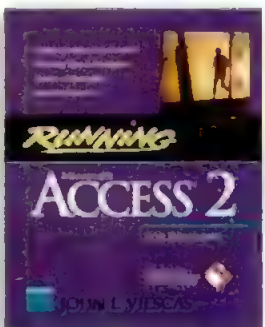
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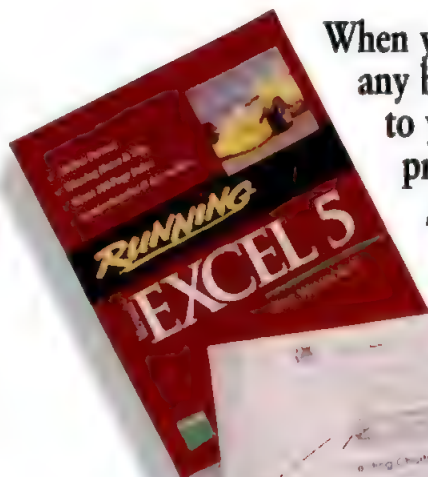


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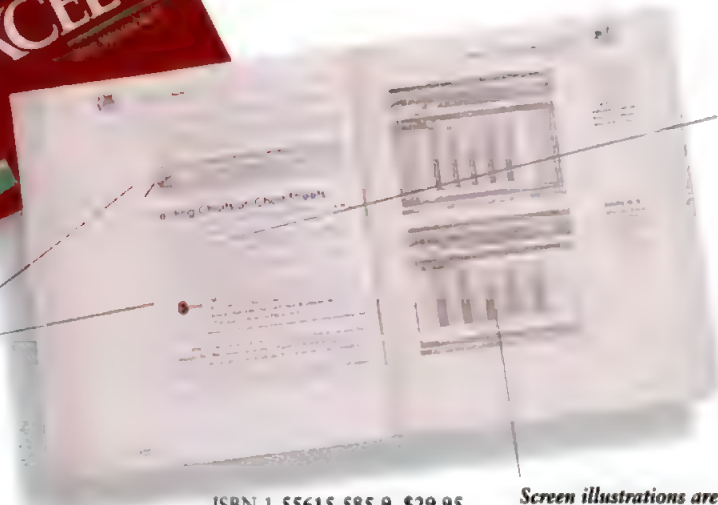


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Read Only

REVIEWS OF THE LATEST BOOKS FOR THE PC USER

Edited by Tin Albano

Grab a Guide and Go Surfin' on the Net

BY ANDREW KANTOR

There are a lot of books about the Internet out there, and new titles appear every day. And as any on-line veteran will tell you, the Internet requires a store-bought guide; it has no user manual.

NOT FOR DUMMIES

Don't be insulted by the title—*The Internet for Dummies* is one of the best ways to get started on the Net. The text is lively and fun to read, and it covers everything from getting hooked up (a list of Internet providers is in an appendix) to using the myriad search and navigation tools. There are plenty of examples, graphics, and detailed information on how to find and get just about anything.

Dummies gives enough history and technical information to keep things in perspective, but not so much that your eyes glaze over. It shows the basics of addressing and using electronic mail and Usenet News, including where to find e-mail addresses and how to use mailing lists. There are plenty of examples, although only a single network newsreader is covered: trn (threaded read news). Users who have other programs will learn the where and the what, but not the how.

Besides communications, *Dummies* covers where to find and how to use the billions of files out there. It shows how to search with archie and WAIS, retrieve files with FTP, and use resources such as Gopher and

the World Wide Web to browse, or "surf," the Net.

Full of examples, tips, and suggestions, *The Internet for Dummies* is a smart choice for the new Internet user.

• **The Internet for Dummies**, by John R. Levine and Carol Baroudi, \$19.95. IDG Books, 800-762-2974. ISBN: 1-56884-024-1.

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SETTING SAIL

The Internet Navigator is a perfect step up for Internet users who connect directly to the Net through their modems rather

than through a LAN. The subtitle says it all: "The Essential Guide to Network Exploration for the Individual Dial-up User." Like *Dummies*, *Navigator* is easy to read and chock full of examples, but *Navigator* goes a step further, giving details not only about what you can find but where you can go to find it.

Navigator is more than a beginner's guide but not quite a reference book. Each chapter is meant to be read as a whole and offers ideas for ways to explore the Internet. The "Files by the Gigabyte" chapter, for instance,

■ The Elements of the Internet

It's thin, it's cheap (older editions are free), and it's the best introductory guide to the Internet available.

It's Brendan P. Kehoe's *Zen and the Art of the Internet* (\$23.95, Prentice Hall, 515-284-6751; ISBN: 0-13-121492-6), a 188-page guide originally released in public domain on the Internet. It was picked up and published in hard copy by Prentice Hall and is now in its third edition.

Zen is a quick-reading, no-nonsense guide to the major tools—and some minor ones—of the Internet. It wastes little time with cute graphics or long lists. It's strictly a how and where book, covering electronic mail, mailing lists, news groups, file transfers, Telnet, Gopher, and more. Buy it, use it, and pass it around.



shows not only how to use archie and FTP to find and retrieve files but also gives specific suggestions for places to look.

By covering so much of the what and where of the Internet, *Navigator* comes up short only on the how. It covers only certain versions of tools: Xmodem but not Kermit or Zmodem, only one newsreader, and only one e-mail program, for instance. But even users with different software need not be concerned—*Navigator's* emphasis is clearly on what you can do on the Internet, and for that it's a gem.

• **The Internet Navigator**, by Paul Gilster, \$24.95. John Wiley

& Sons, 800-225-5945. ISBN: 0-471-59782-1.

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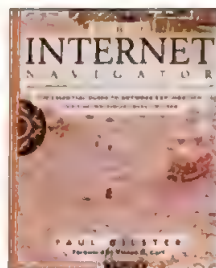
EASY REFERENCE

When it comes to reference guides for the Internet, Daniel P. Dern's *The Internet Guide for New Users* is tough to beat. The title is a misnomer; this is no beginner's book. Rather, it's a top-notch reference guide to the history, tools, and features of the Internet.

Besides the basics—how to send mail, use news groups, and work the Internet tools—*The Internet Guide* gives a detailed history of the Internet, plenty of information on using Unix (the operating system of choice on the Net), and guides to security, commercial services, software, and literally everything you would want to know.

• **The Internet Guide for New Users**, by Daniel P. Dern, \$40.00. McGraw-Hill, 800-262-4729. ISBN: 0-07-016510-6.

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Michael J. Miller

The Object of the Game

Object-oriented computing is already becoming a bit of a buzzword that means all sorts of different things to different people. To developers, it promises easier application development, but at what appears to be a high initial price because of the steep

learning curve. To end users, object-oriented computing promises better integration of software applications, which will eventually lead to more choices. These benefits, however, still seem to be a couple years away.

Nevertheless, we've seen a lot of change in the past few months, and a lot more progress seems to be just on the horizon. The results could mean not only better application integration, but also an increase in software development, much improved products, and perhaps a whole new style of entertainment.

MICROSOFT'S OBJECTIVE

Right now, objects are mostly the province of compilers and applications using Microsoft's OLE (Object Linking and Embedding) technology. Microsoft's latest software applications employ OLE 2.0 to good effect, and virtually all major business-software vendors I've talked with plan to implement OLE 2.0 to some extent in their software products during the course of the year. In addition, Microsoft has positioned OLE as a core API in the upcoming Chicago project.

OLE is clearly on its way to becoming an industry standard. But questions still remain. OLE has been harder to use than most developers would like, though new compilers are making it easier.

It's sometimes easy to confuse OLE objects with the VBX-style controls found in Microsoft Visual Basic. Both deal with things that can easily be added to applications by end users or developers, but they are very different from each other. Microsoft recently unveiled a new variation called OLE Controls, which is meant to bridge the gap, but there is still a significant difference.

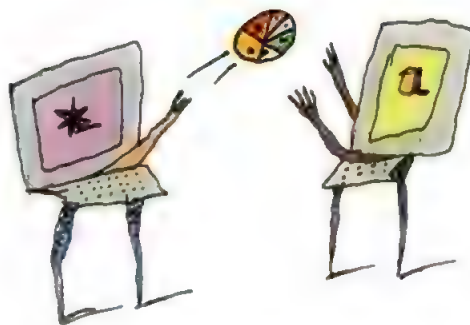
OTHER VOICES, OTHER OBJECTS

While OLE is gaining momentum, its primary competitor, OpenDoc, finally seems to be getting its act together. OpenDoc is a standard set of APIs for creating components of applications that work together. It's backed by a group of Microsoft competitors including Apple, Borland, IBM, Novell, and WordPerfect. OpenDoc consists mostly of technology donated to and controlled by a consortium called Component Integration Laboratories (CIL).

CIL is responsible for the basic technologies, and for making sure that they are made available to the industry. Apple, which contributed the original technology and the Bento file format, as well as the Open Scripting Architecture for scripts that work across applications, is finishing work on OpenDoc for Macintosh. IBM, which contributed the underlying System Object Model, is working on OpenDoc for OS/2. And WordPerfect is working on making OpenDoc work transparently with OLE. It's also working on a version of OpenDoc for Windows. All of these versions should be available shortly.

Why should people care about OpenDoc if OLE is already out there? CIL and its supporters agree that OLE works for integrating applications under Windows. But according to its supporters, OpenDoc is cross-platform and is stronger because it's much more suited for developers who want to break down their software applications into component parts.

To demonstrate OpenDoc's prowess, developers show various components—including a text editor, drawing program, and multimedia viewer—interacting within the same document. What makes this impressive is that all of



*Mix and match your
favorite software parts to create
truly personal programs.*

Michael J. Miller

the elements in the document can be active at the same time. This means that the video viewer can continue to play even when the user is drawing or editing text. Moreover, to add to the drama, the demonstration takes place on a midrange PowerBook and takes up relatively little memory—approximately 4MB.

WordPerfect is a big believer in OpenDoc. Over time, it plans to use OpenDoc to break down its flagship word processor into components. Of course, as with most new technologies, we'll have to wait to see how well it really works.

On other levels, more work is going on in order to make applications more object-oriented. One of the more interesting projects is from Taligent, the joint venture of Apple, IBM, and, recently, Hewlett-Packard that is creating new *frameworks*—or code bases that form the skeletons of applications. Taligent's new frameworks are being designed to make it easier for developers to create new applications, as

well as a complete operating system.

IBM is already shipping some developers early versions of Taligent frameworks that work on top of OS/2. Taligent is an operating-system company, and in addition to delivering frameworks to IBM and Apple, it plans to ship its own operating system based on those frameworks.

Still, Taligent frameworks may well find that most of their competition—at least initially—will come from frameworks with C++ compilers, such as Microsoft Foundation Classes (MFC) and Borland's ObjectWindows Library (OWL).

PARTS IS PARTS

So what does all this mean for you and me? It means that the dream of taking our favorite parts of different applications and combining them with one another is coming closer to reality.

We should begin to see smaller developers creating components that are aimed at specific tasks and specific industries. Eventually, this could mean that every company will run a different combination of components in its own applications. What this might mean for setup and support is anyone's guess, but it should cer-

tainly be interesting.

In addition to impacting the business world, object-oriented computing could significantly change the way we use entertainment software. Already, companies like Maxis are talking about "object-oriented" games. The first step has already been taken. We've heard rumor of a third-party product that lets you take SimCity simulations and use them in conjunction with Flight Simulator. This means you can land airplanes in cities you've created.

Eventually, you should be able to take a character from one game and place him, her, or it in another. Perhaps you could create an environment in one program and characters in another and combine them to create your own original situations. Add the new multimedia and virtual-reality technologies and you can begin to imagine stepping inside worlds of your own creation. While the components you use might be standard, the end results would be uniquely yours.

The possibilities of combining applications—both in business and in the home—are seemingly endless. Object-oriented computing could mean the start of really personal computing. □

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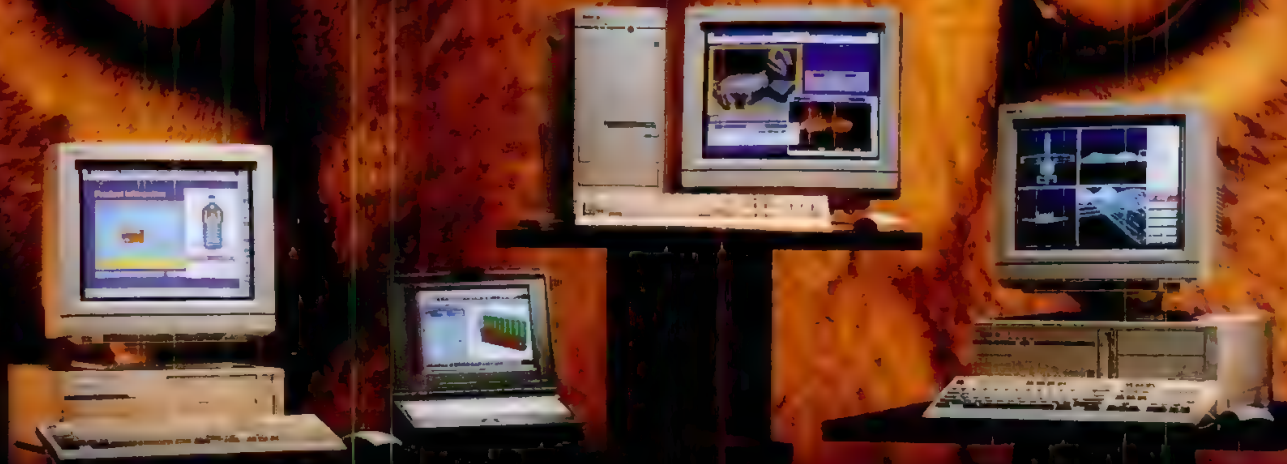
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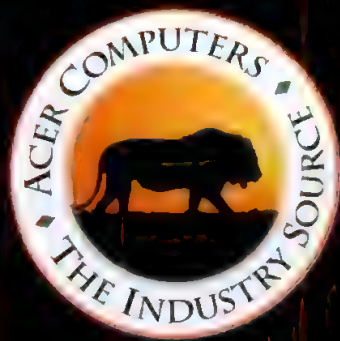
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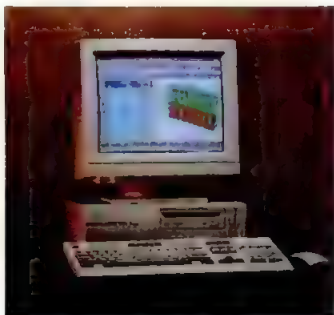
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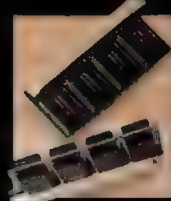
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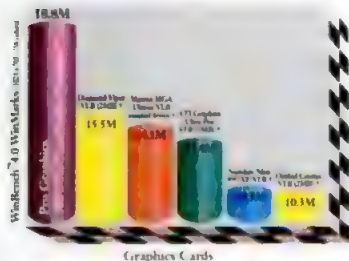


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Bill Machrone

The Ultimate Output Device

Hundreds of thousands of words have been written in the unceasing quest for the ultimate input device. Keyboards, mice, trackballs, pens, touch screens, and the like have occupied center stage since the dawn of the personal computer. We

give relatively little thought to the possibilities of output devices.

Printers have gotten remarkably better and cheaper in recent years, but sometimes you need something more than the same old two-dimensional, document-centric approach to the world. It's time to expand your horizons into some truly unique forms of output.

One company, Roland Digital Group, seems to have cornered the market on weird and wonderful output devices. Its latest addition to an already intriguing product line is the STiKA, a dandy little device that takes your on-screen typography and images, and cuts them into vinyl tape. Imagine producing logos, banner materials, iron-ons, and text, all rendered in shiny vinyl. Think of the great promotional doodads, from custom report covers to caps to banners, with images up to 2.5 inches high by 16 inches long. One of the fun things about using a device like this is that you get the positive and negative images in one pass, which gives you some interesting possibilities for special effects.

The STiKA is actually a plotter, which isn't surprising if you're familiar with Roland Digital's product line. Aside from all its music products under the Roland and Boss nameplates, Roland seems to enjoy controlling things with servomotors. It doesn't take much to turn a plotter into a film cutter: You just replace the pen with a swivel knife. This one is particularly compact and well integrated. Sign makers have been using swivel-knife-equipped plotters for years, often one of the STiKA's big siblings, such as Roland's CAMM-1/20. The STiKA has a secret weapon, though. Tucked in its lumpy, unlovely housing is a scanner. The included SignMate software converts the scanned images (plus just about any other image

you can put on the screen) into outlines, which become cutting instructions for the STiKA. It cuts other materials, too, including professional sign maker's vinyl and flocked iron-on material. The results are surprisingly sharp and professional-looking. Not bad for a machine that costs \$499 with software included.

LET'S GET PHYSICAL

PCs have always had trouble manipulating the real world. Output is relegated to two dimensions or the just barely 3-D result you get from a product such as the STiKA. Roland Digital gives you masterful control over the third dimension with the CAMM-3, a desktop-size, computer-controlled milling machine. If you can draw an object with one of the popular 3-D CAD packages, the CAMM-3 can then make the real thing for you. Granted, you may not have too many applications for a milling machine around the everyday, paper-driven office, but where modeling and manufacturing are the game, the CAMM-3 is in a class by itself. It will cut woods, plastics, soft metals, and the specialized waxes used by the CNC (computer numerically controlled) machining market. Wax is popular because you can collect the shavings (and the unsuccessful prototypes) and melt them down again for reuse.

The CAMM-3 is aimed primarily at the back end of the design process (before a product moves into manufacturing). As a tabletop milling machine, however, it is just the ticket to create one-of-a-kind parts to do a specific job or limited production runs of small parts. It has a reasonable amount of brainpower on-board, including a buffer large enough to hold all the tool-path commands for the job at hand. The PC downloads the instructions into the buffer, and then is free for



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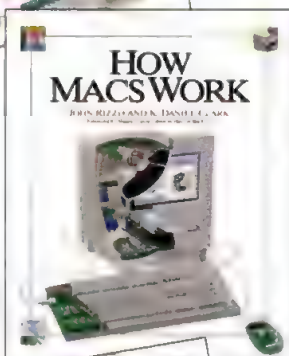
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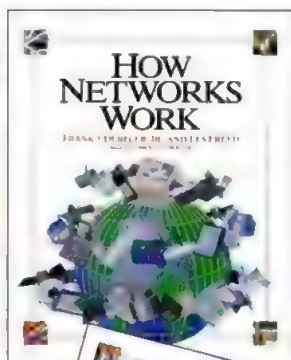


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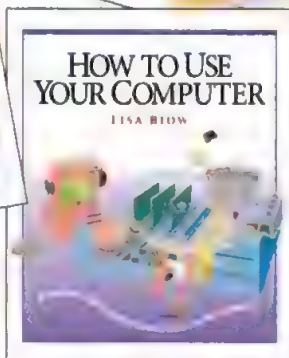
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other work. The robotic principles that guide the CAMM-3 are simple enough, but it's enormously satisfying to watch your conceptual design become a physical reality. The basic model CAMM-3, the PNC-2500, isn't cheap at \$12,500, but it's a fraction of the cost of a full-size CNC milling machine.

A STITCH IN TIME

Given the diversity of their product line, the folks at Roland Digital are probably kicking themselves for not having come up with the Huskygram, from Viking Husqvarna. The Huskygram is utterly unique: a computer-controlled embroidery machine. Forget that new 20-page-per-minute printer; this is what you really need to put on the network! Imagine your ideas immortalized in apparel instead of committed to recycling bin-bound paper. Now you can celebrate even the most trivial achievements with commemorative jackets and embroidered ball caps, free from such annoying constraints as setup charges, minimum orders, and committee approvals.

The Huskygram can embroider images as large as 14 inches square and produce letters up to 2 inches high in a variety of graceful styles. The Huskygram does beautiful work. Perhaps we'll get one into PC Magazine Labs and put it through its paces on a wide variety of materials, such as denim, satin, sweatshirting, and leather. We'll need to build a resolution test, keep thread-breakage statistics, and take a hard look at the cost of ownership over the long haul.

The Huskygram takes up only a bit more than a square foot of desktop real estate and stitches in 14 different colors. Although you have to change threads with each color change, the Huskygram is far faster than embroidering by hand. The Huskygram comes in two flavors, the CS-1 at \$1,699 and the CS-2 at \$2,199. The included software lets you rotate, mirror, and stretch your design, assign colors and stitch types, and then print—er, stitch—them out. The CS-1 uses designs from libraries of disks, while the CS-2 lets you embroider any .PCX image.

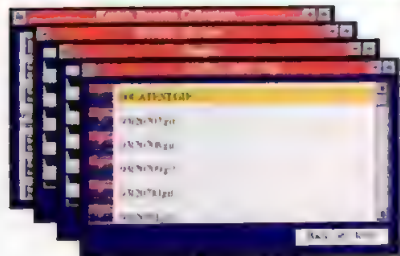
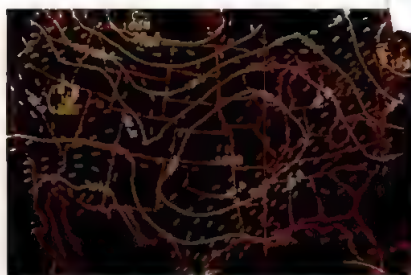
There you have it: Machines that slice, cut, and stitch in the ongoing quest for real-world output. You can reach Roland Digital at 714-975-0560 or 800-542-2307 and Viking Husqvarna at 216-252-3300. □



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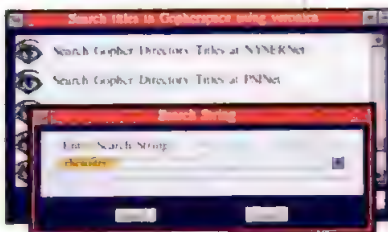
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WinGopher	
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John C. Dvorak

IBM's Workplace OS Explained

Have you wondered why IBM decided to drop its license to make the Pentium? It's because of the Workplace OS, IBM's not-so-secret futuristic weapon. It will be either the definitive operating system of tomorrow or a massive flop.

The Workplace OS is part of a grandiose plan based on the ubiquitous MACH kernel developed at Carnegie Mellon. IBM is banking on this unique operating system to be the core technology that will bring the PowerPC into the mainstream. Hence, no need for the Pentium.

The Workplace OS is a little like a jigsaw puzzle and a little like a Chinese menu. In theory, it will let you work in any environment and on any platform you want. The Workplace OS runs these environments as "personality modules," either interchangeably or simultaneously. The core of the Workplace OS is a master module called Neutral Services, which rides on top of the target chip and performs two functions: It talks to the chip and the BIOS at the machine level, and it hooks into a personality module—say, Windows. The personality module lets you run your Windows apps on a PowerPC, MIPS, or DEC Alpha as if you were running Windows on a 486. You can pop off the Windows personality and mount an OS/2 personality to run OS/2 apps.

Now, when IBM first started talking about the Workplace OS, it indicated that you could run native Mac 68000 apps on a Pentium running the Workplace OS with a Mac personality module. I still laugh when I hear this. I just don't think IBM will ever develop the Mac personality module. These personality modules—which have to orchestrate the program's instructions and feed them into the Neutral Services module—seem like the hard part of the plan. IBM says the Workplace OS is almost ready to ship, but will there be anything other than Neutral Services? We'll know this year.

The Workplace OS has Microsoft spooked. While you won't hear much about it from Microsoft, you will hear about it from Lotus. Here's why. Any complex application with its own

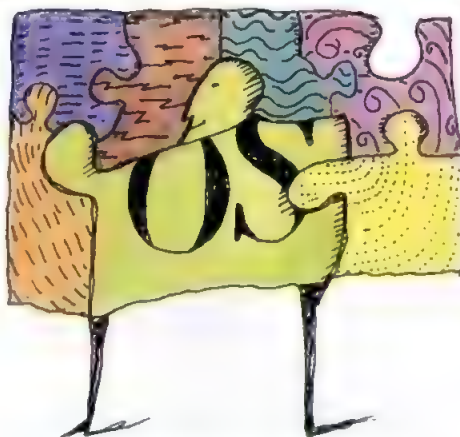
interface—say, Lotus Notes—can attach directly to Neutral Services and bypass the personality module. According to rumor, the performance increases for such applications are phenomenal. Notes annoys Microsoft to no end, since Microsoft has no competitive application. And when Notes is directly connected to the Workplace OS, Microsoft can't blindside Lotus with some fancy new Windows release that coincidentally trashes Notes. The alleged "DOS Isn't Done Until Lotus Won't Run" plot won't work.

Another prospect bugging Microsoft is that one of the personality modules for the Workplace OS is Taligent—another thing nobody at Microsoft wants to talk about. Taligent's role in the world is to create an environment in which all the applications we buy individually are built directly into the operating system. Because the apps are programmable, you can put together your own custom-made suites. Taligent could mean the end of all applications as we know them.

This is why Microsoft is so panicky about its new operating systems—Chicago, Cairo, Daytona, and Snowball. Anything to distract people. This is also why applications vendors are bundling everything they have into one product.

The suites are here to battle Taligent. With Microsoft Office the hottest-selling product on the market, it's clear that buyers' tastes are headed right toward Taligent. Microsoft is aware of this trend and probably wishes the suite idea weren't catching on so well.

The remaining question about the Workplace OS and Taligent is: Will any of it really work? When IBM dropped its license for the Pentium, I assumed that somebody at the company had already determined that the Workplace OS will work all right, especially on the PowerPC.



IBM is banking on a unique operating system that could bring the PowerPC into the mainstream.

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CIRCLE 176 ON READER SERVICE CARD

Inside Track

Is AT&T going to be the next carcass for Microsoft's bone-pickers? Apparently yes, if AT&T's Robert Kavner has his way. Or so the rumor goes. But if AT&T old-timers have their way, the answer will be a resounding no. I'm told an internal battle within the AT&T executive suites has broken out concerning a deal Kavner wants to do with Bill Gates.

The story began in late 1993 after Gates and Microsoft were essentially shut out of the CableSoft deal, whereby Microsoft was going to make its move into your home and mine by joining with John Malone and Tele-Communications Inc., among others. Gates kept trying to get a bigger and bigger piece of the pie until the partners gave up on him. The distraught Gates then got wind that an AT&T powwow would take place at an executive friend's mansion near Gates's house on Lake Washington near Seattle. The executives somehow ended up at Gates's house, where good old Bill convinced Kavner that AT&T needed Microsoft.

The idea is to get AT&T into the set-top/cable-TV/interactive-TV business using Microsoft operating systems and software. At the Consumer Electronics Show (after the Kavner-Gates handshake), Kavner gave a keynote in which he condemned the cable operators and made a veiled reference to John Malone. Kavner complained that the cable operators were acting like "gatekeepers" and restricting (censoring) the information flow. This was Bill Gates talking, sticking it to Malone as best he could.

It looks as if this is just another ho-hum strategic relationship, but there may be a hidden agenda here. Kavner controls the AT&T relationship with General Magic, the Apple spin-off company that makes the software expected to dominate the personal-communicator scene. Microsoft would like to see the relationship between AT&T and General Magic soured. Some cynics even suggest that Kavner is going to end up actually working at Microsoft. This scenario stems from paranoia and is an impossibility. Imagine the AT&T shareholder lawsuits! And besides that, there's already a deal-killer lurking. For Microsoft to join forces with AT&T, AT&T has to agree to use Microsoft software exclusively (with emphasis on Windows NT). The idea that Windows NT will be used at all by AT&T more than irks a few of the Unix promoters within the company. Still, in late February, AT&T announced with NCR (wholly owned by AT&T) a humongous worldwide forum on Windows NT. The forum was held at the

*Microsoft would like to see
the relationship between
AT&T and General Magic
go sour. Some cynics even
suggest that AT&T's
Kavner is going to work
at Microsoft. Imagine
the AT&T
shareholder lawsuits!*

AT&T/NCR product center in New York and sent via satellite to "customers in AT&T/NCR sites around the world." I found the whole thing odd. Keep an eye on this relationship. Something's going on here.

Better Late than Never (I Suppose) Dept.: If you use the Internet, you should be aware that for the last six months or so there has been a rogue "sniffer" program roaming the network capturing every password it can find. I was told that the Internet muckamucks were aware of the problem, but had been unable to stop the offending code and unable to figure out where it originated. I was also told they had no clue as to the final disposition of the collected passwords. All they could do is tell users to change all

passwords routinely (duh!). All of this could be part of a student thesis to study password use and derive statistical data regarding passwords. The most frequently used password is still password or the person's own name.

Genuinely Interesting Hardware Dept.: When you travel overseas, you run into situations where you can't connect your laptop modem to the local phone system. In most foreign countries, it's simply illegal to hook a modem to the phone line. So I always carry a small Konexx acoustic coupler (\$149). It has small movable cups and a velcro strap, so it attaches to any phone. It can operate at speeds of up to 14.4 Kbps (no kidding!). I've even managed to get connected on the miserable phone system in Brazil. This is a handy device for any traveler. Call Unlimited Systems at 619-622-1400 for info. **Highly recommended.**

Carrying the Mainframe on the Back of the Micro Dept.: I wonder how the retired mainframe and minicomputer makers feel about the Dataquest computer-sales figures for 1993. Worldwide sales of computer systems have jumped to \$120.7 billion. Personal computers accounted for \$66.3 billion, while mainframes fell to \$21.2 billion. Midrange computers were also at about \$21 billion. Sales of workstations and supercomputers accounted for the rest. Do these numbers tell you how wrong the mainframe makers were in the late 1970s when personal computers emerged? Next the minicomputer makers screwed up. So instead of Digital and Data General dominating small systems, we have Apple, Compaq, and Gateway. Somewhere in the mess, IBM wised up and did a marvelous job of playing catch-up. IBM is second only to Apple in small systems. But there are still diehards in the business who don't take the \$66 billion market for desktop computers seriously. This proves that you don't have to be smart to be in the computer business. □



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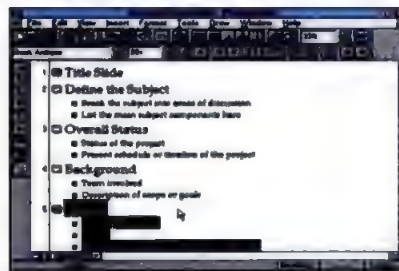
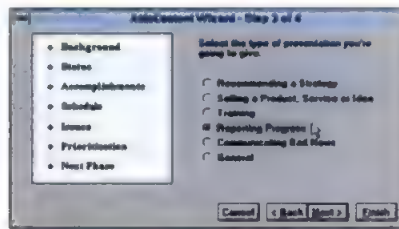
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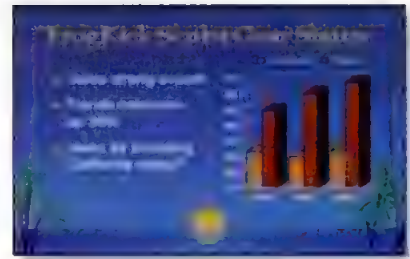
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Jim Seymour

Now Playing: Your PC, in Full Voice

Have a sound card in your PC? If so, I'll bet you have no idea how good your PC can sound. Whether your PC is 8-bit, 16-bit, or whatever, I'm willing to wager that your PC's capable of producing far better sound than you've ever heard from it.

Why? Because you probably have a pair of those dreary little animal-cracker-box speakers hooked up to it—the el cheapo specials that came with your sound card. The quality of the giveaway (oops, “bundled”) speakers that come with most sound cards is terrible. If you like the sound produced by those \$10 transistor radios from the fifties, you may like these little grunts, but for those whose usual sound sources include a Sony Walkman or Discman, a good car sound system, or even a cheap compact stereo, those bundled bombs have got to go.

How should you start to improve your PC's sound? It depends on your space, your budget, and the tolerance level of the people who live or work around your PC. If you're huddled in a small office cubicle in the midst of one of those open offices, the only answer may be a pair of decent headphones. If you have a portable cassette or CD player, try the headphones that came with the unit. The cord, with its stereo miniplug, works with almost all PC sound cards. While the quality will fall short of what you'd hear from good speakers, it'll be better than what you'd hear through those bundled speakers, and you'll still be able to hear your phone ringing.

Higher-quality, closed-ear-style headphones, available from Sony, Koss, and others, range from \$40 to \$90 and are a better choice at home, where sealing out various room sounds is more acceptable.

WHEN VOLUME IS NO OBJECT

If your PC is at home or you work in a setting where sound from your computer isn't likely to bother others, then you're ready for the big surprise of good PC speakers.

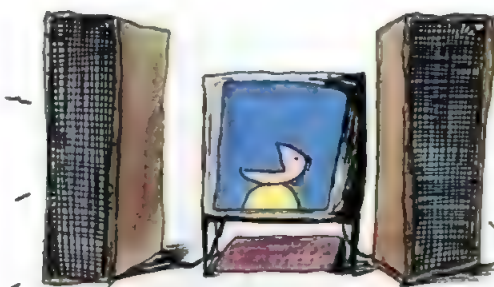
Though we refer to PC sound sources as *speakers*,

we're talking about more than just two little loudspeakers. Add-on speakers combine a stereo amplifier (hidden inside one of the speaker cabinets), an AC power supply, and two separate stereo speakers. Because they're usually placed next to your monitor, these speakers must also be shielded lest their magnetism distort the monitor's display. It's no surprise that the bundled speakers—which often cost sound-card makers as little as \$6 to \$7 a pair—aren't very good: At that price, they can't be. It's also no surprise that a pair of good PC speakers can cost \$70 or more.

At the bottom of the price range, the best I've heard are AR 22s (soon to be renamed Advent 22s), from the Acoustic Research division of International Jensen. You'll pay about \$70 a pair for them, and if you're used to the tinny sound of bundled speakers, you'll be astonished. The AR 22s are also tiny, which helps them fit easily onto the typically crowded PC desktop. The speakers don't provide much bass below 100 Hz, but that's to be expected, considering their small size and price. I like the AR 22s so much that I bought a second pair to use with my Sony Discman when I'm traveling; now I have glorious music in my hotel room.

At about \$90, Yamaha's YST-M10s are the next step up. About half again as large as the AR 22s, the M10s sound great, with more bass. Close competitors to the Yamahas are Sony's SRS-58s, also about \$90, but I find the Yamahas better for music. All three units take up little space on your desktop by virtue of their small footprints and upright design.

For better sound (and perhaps more volume) than you'll get from the AR 22s, YST-M10s, and SRS-58s, you need to move into what amounts to Serious Speakers. Three units are dimi-



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Jim Seymour

nant here: Bose's aging RoomMates, Altec-Lansing's ACS-300s, and AR's Powered Partners 570s.

I've had a pair of self-powered RoomMates on my Macintosh for six years. They sound good but not great and are a bit pricey at \$275. Current-production RoomMates seem to have more bass but also more midrange distortion.

When Altec-Lansing's \$270 ACS-300 speakers appeared three years ago, combining two clamshell-style desktop units with a foot-warmer subwoofer, they were dazzling. Few of us had heard such wide frequency range and sheer volume from PC sound sources; the ACS-300s became the high-end standard. Listening over time, though, has revealed more distortion than I like. The sound is good, but that edginess of distortion in loud passages grates on me.

This may not be important. If you mainly want the *swishhhhs* and *toiiiings* and *ka-ka-ka-boiiiings* of PC games, you probably won't notice distortion from any decent PC speakers. The ear detects and the mind is bothered much more by distortion in music than in sound effects.

The best high-end PC sound I've heard comes from the AR 570 speakers. Their relatively large wedge shape (about 10 inches high with a 6- by 7-inch footprint) may be hard to accommodate on your desk. Of course, you can put them under your desk if that doesn't spoil the stereo effect for you.

At about \$300, AR 570s aren't cheap, but they're very, very good. In fact, they're better speakers than many of us have in our stereo systems.

Speaking of which, have you considered simply connecting your PC sound card to your stereo? The output of sound cards is compatible with the Aux, CD, Video, Tape In, and Line In inputs of almost any stereo, and even the smallest mini-stereo speakers will sound better than the cheap speakers bundled with sound cards and multimedia PCs. If your PC and stereo are in the same room, give this a try. But if the stereo's speakers are across the room or along a wall to your side, you'll lose the popular in-your-face quality of PC sound.

However you hook up your PC's sound card, lose those cracker boxes that came with it. With good speakers on your PC, you'll be floored by how much you've been missing. □

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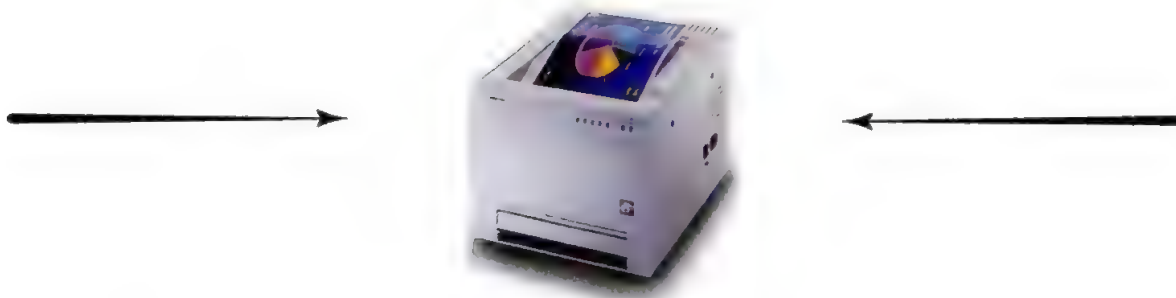
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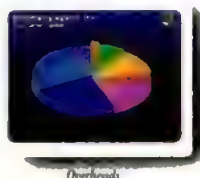
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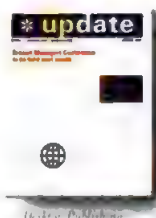
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In 1993 alone, Micron brought home an impressive array of industry awards. Micron's newest semiconductor facility was named "Top U.S. Fab of 1993" by Semiconductor International Magazine; Micron computer systems were awarded a PC Magazine Editors' Choice; PC World's Best Buy; Windows Sources' Experts' Pick; and Byte Magazine's Best Value for both Windows and UNIX applications. PC Digest gave Micron systems a 4-star rating based on performance and price. In PC Magazine's 1994 Readers' Choice Service & Reliability Awards

Micron received the highest ratings available in the categories of Overall Reliability, Satisfaction with Technical Support and Future Likelihood of Buying again. That's why Autodesk selected Micron as PC supplier for 1994 tradeshow.

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Micron customers benefit from strong ongoing relationships with industry leaders such as Intel™ and Microsoft®. Micron is leading the industry with systems featuring Intel's new DX4 100MHz microprocessor with up to 50% greater performance than any previous 486. Micron also brings you systems that combine Intel's 66MHz Pentium™ microprocessor with the enhanced performance of PCI/EISA bus architecture. Since the finest hardware deserves the finest software, Micron offers you the unique value of Microsoft Office on CD or Microsoft Works Multimedia on CD with every new system.

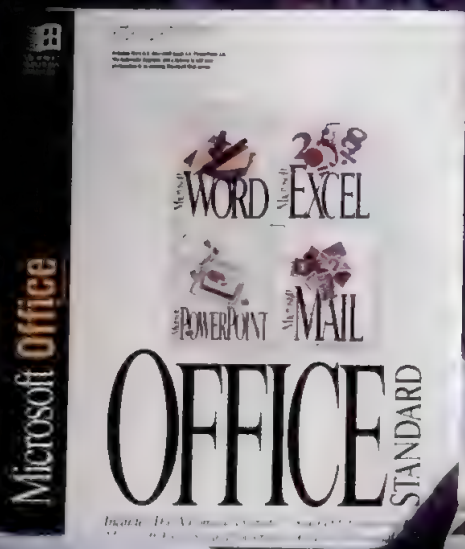
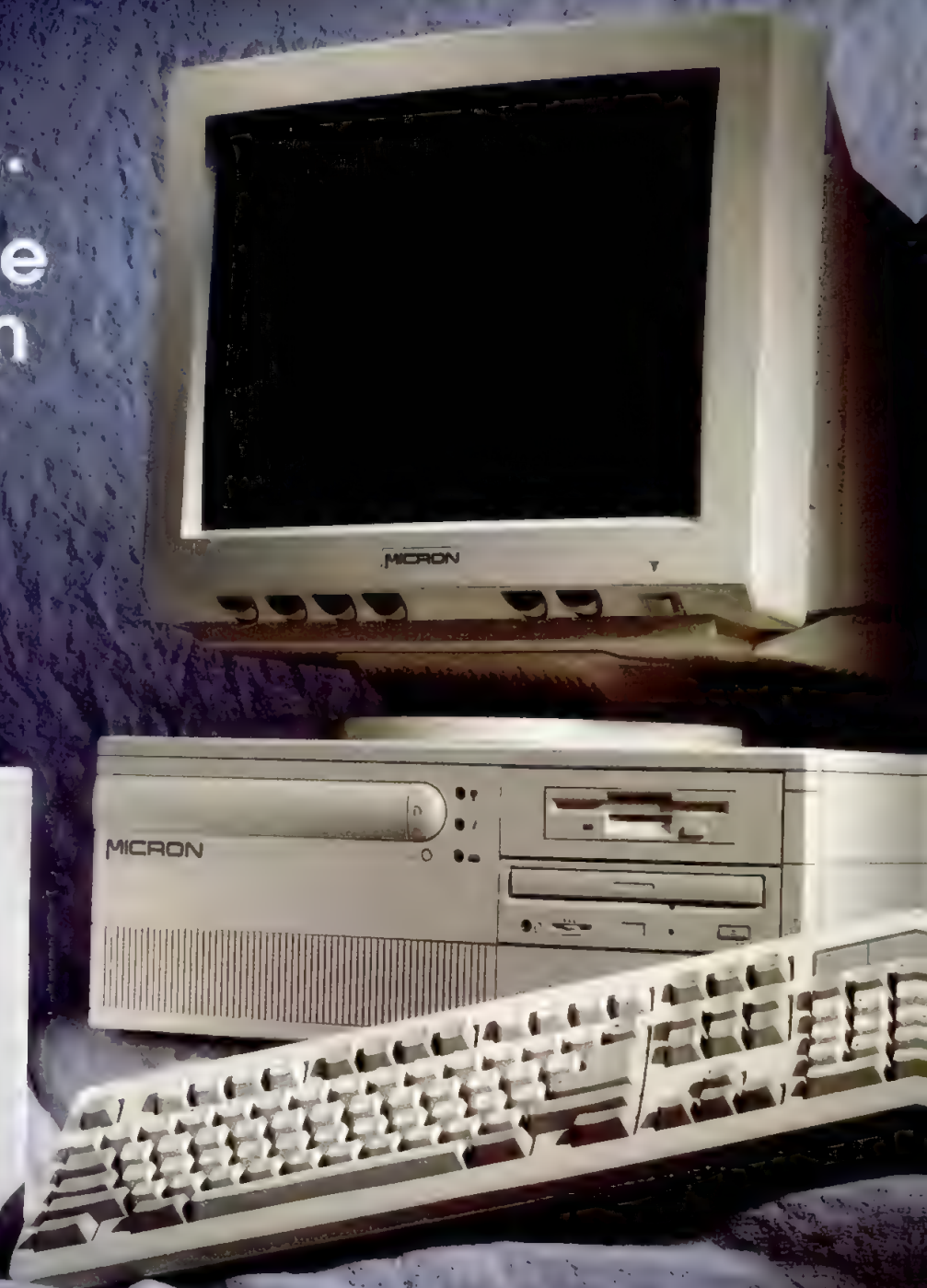


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DRAM



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100MHz Systems from Micron

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- 256K 15ns write-back cache, Flash BIOS
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- PCI graphics accelerator (2MB)
- 14" Micron 14FG, 1024NI, .28mm, MPRII
- Desktop "Tool Free" chassis
- Microsoft Mouse, 101-key keyboard
- MS-DOS & Windows for Workgroups
- Microsoft Works Multimedia on CD

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- 1Mb Flash BIOS by Phoenix
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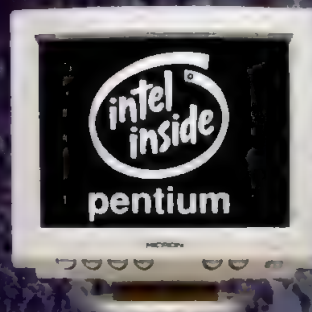
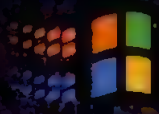
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- 256K 15ns write-back cache, Flash BIOS
- 7 expansion slots: 2 VESA, 7 ISA
- 2X CD-ROM drive, 3.5" floppy drive
- Diamond SpeedStar Pro VLB (1MB)
- 14" Micron 14FG, 1024NI, .28mm, MPRII
- Desktop "Tool Free" chassis
- EPA Energy Star compliant
- Microsoft Mouse, 101-key keyboard
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- Microsoft Works Multimedia on CD*

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- 2X CD-ROM drive, 3.5" floppy drive
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- Desktop "Tool Free" chassis
- EPA Energy Star compliant
- Microsoft Mouse, 101-key keyboard
- MS-DOS & Windows for Workgroups
- Microsoft Office for Windows on CD*

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- 256K 15ns write-back cache
- 1Mb Flash BIOS by Phoenix
- 4 ISA, 2PCI, 1 ISA/PCI slots
- 2X CD-ROM drive, 3.5" floppy
- PCI graphics accelerator (2MB)
- 14" Micron 14FG, 1024NI, .28mm, MPRII
- 2 16550 serial ports, 1 parallel port
- Desktop "Tool Free" chassis, 3 cooling fans
- Microsoft Mouse, 101-key keyboard
- MS-DOS & Windows for Workgroups
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- 8 expansion slots: 2 VESA, 8 EISA
- 2X SCSI-2 CD-ROM drive, 3.5" floppy
- Diamond SpeedStar Pro VLB (1MB)
- 14" Micron 14FG, 1024NI, .28mm, MPRII
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Bill Howard

Memo to Vendors: Cut It Out!

The claim in the advertising mock-up was incredible: A new 64-bit video board that “breaks the 100 million WinMark barrier.” Incredible because the best video-board performances we’ve seen this year at both PC Magazine Labs and ZD Labs

have been Graphics WinMark scores more on the order of 25 million pixels per second.

There’s no mystery how Vendor A got such a high score: Vendor A tested with an old version of the Ziff-Davis benchmark test suite, Winbench 3.11, which hasn’t been used since last summer. There’s little mystery why a vendor would like to use the old tests. The numbers are more dramatic, and as Vendor A lamely claims, “Vendors B and C are doing it, so we have to also.” It’s an excuse that sounds marginally better than “My dog ate the new benchmark test disk, so I had to use the old one.”

USE THE NEW TESTS!

Both old and new sets of Graphics WinMark tests report the results in millions of pixels per second, but that’s where the similarity ends. WinBench 4.0 tests were written based on extensive profiling of the routines found in the most commonly used Windows applications; they offer a better mix of tested instructions and are less susceptible to optimizing. Optimizing is what *your* company attempts in order to look good on benchmark tests; when your competitor does the same thing, it’s called cheating.

Winbench 3.11 was useful, but as hardware and software moved forward, our tests had to move forward, too. So while the highest of the old-style Graphics WinMark scores may have been two to four times as high as the best of the current WinBench 4.0 Graphics WinMark scores, “There’s no magic transformation that can turn a Winbench 3.11 result into a WinBench 4.0 score . . . Their results are just not comparable,” according to Ziff-Davis Benchmark Operation (ZDBOp) codirectors Mark L. Van Name and Bill Catchings.

Bear in mind that we now use two types of Win-

dows performance tests: an application-level benchmark test (Winstone 94) that measures overall performance and a synthetic component-level benchmark test (WinBench) that measures a PC’s video (Graphics WinMark) and hard disk (Disk WinMark) performances. Plug two different video adapters into the same PC and the difference between the system’s Winstone 94 scores will be far less dramatic than the difference between its Graphics WinMark scores, and that’s just the point. The smaller difference is a reflection of how much faster (or slower) your system will perform when you add one hot new component to the existing mix.

We’re concerned because we’ve invested hundreds of thousands of dollars in researching and developing benchmark tests that help our readers determine which PCs and peripherals offer the most bang for the buck. We’ve seen the Graphics WinMark tests become the PC-industry standard for measuring video performance, and we don’t want to see such an important benchmark set of tests be party to marketing sleights of hand.

So we’re calling on vendors to clean up their acts and use the current benchmark tests. Also, vendors, you should footnote what equipment was used for testing: A

66-MHz Pentium boosts the performance of a video card more than a 486DX/33 does. And please don’t try to optimize your video drivers to look good on tests without a corresponding ability in the real world.

We have a licensing staff that watches for transgressors misusing our test results, but sometimes a few ads and press releases slip through. If you see something that looks odd, contact us at one of the mail or e-mail addresses listed at the front of the magazine. We’ll check it out. Think of this as your contribution to the Neighborhood Benchmark Test Watch. □



When a vendor advertises a benchmark test score that seems too good to be true, it probably is.

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- 15" FST-NI color monitor, LR
- 3.5" 1.44MB diskette drive
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- 540MB (12ms) IDE hard disk
- 5 drive bays
- Local bus IDE controller
- Local bus graphics accelerator, 1MB
- 15" FST-NI color monitor, LR
- 3.5" 1.44MB diskette drive
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- MS-DOS 6.2, Windows 3.1, mouse

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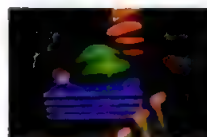
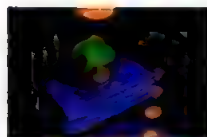
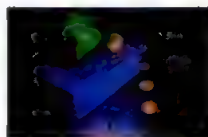
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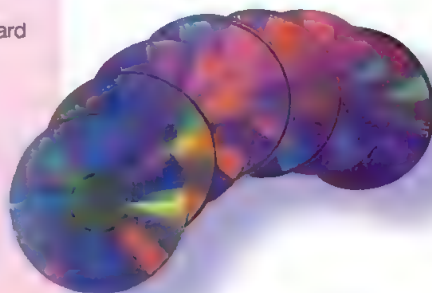
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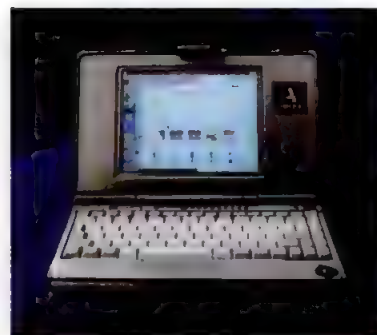
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- 5 drive bays
- Local bus IDE controller
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- Upgradable to Pentium technology
- 16KB L1, 128KB L2 cache
- 8MB RAM, max: 64MB
- 4 16-bit ISA, 1 32-bit VL bus slot
- 540MB (12ms) IDE hard disk
- 5 drive bays
- Local bus IDE controller
- Local bus graphics accelerator, 1MB
- 15" FST-NI color monitor, LR
- Double-speed Multisession Multimedia Kit
- 3.5" 1.44MB diskette drive
- Lexmark PS/2-style 101-key keyboard
- MS-DOS 6.2, Windows 3.1, mouse

\$2,599

66 MHz Blue Lightning

- 486 Blue Lightning, 66 MHz
- 4MB RAM, max: 64MB
- 240MB (15ms) IDE hard disk

- Integrated 32-bit SCSI-2 controller
- Integrated Ethernet (10BaseT)
- 14" SVGA color monitor, LR

\$1,725

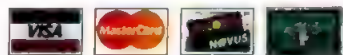


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ENERGY STAR PCs

POWER TO THE PC



Which uses more electricity, a desktop personal computer or a 60-watt light bulb? If the federal Environmental Protection Agency and the majority of PC makers have their way, the light bulb will not only consume more power but likely produce more heat as well.

Enter Energy Star, the EPA-inspired movement to encourage the use of computers that use a minimum amount of power (for more information, see "The Green Machine" in our issue of May 25, 1993). The goal of this voluntary program is to lower the total electrical consumption for new entry-level and midrange PCs to 60 watts or less (30 watts for the system unit and 30 watts for the monitor) while at idle—a power-conservation scheme analogous to that used by a notebook computer in sleep mode.

Energy Star-compliant systems are aimed squarely at the middle of today's PC

Looking for a great mainstream personal computer that offers 486 power and saves on your electricity bill? In search of the fastest and most affordable PCs, *PC Magazine* takes a look at 38 of today's most advanced desktop computers that meet the government's Energy Star power conservation requirements.

By Brian Nadel



► IN THIS REVIEW

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market; characteristically, they are 486 systems that include large hard disks, accelerated video, and, sometimes, CD-ROM drives and sound cards. From a performance perspective, they're dwarfed by high-end Pentiums PCs but easily overpower 386s.

REVIEW CRITERIA

To be included in this roundup, vendors were asked to submit a 486-based system

equipped with a minimum of 8MB of RAM, a 200MB hard disk, and a 14-inch monitor, all for less than \$2,500. Those who wanted to send an additional 8MB of RAM or a CD-ROM drive were given a \$300 allowance in our price ceiling for each. We received 38 systems ranging from a 33-MHz 486SX-powered Compaq DeskPro XE 433s M270/w all the way to 26 486DX2/66s. Prices ranged from \$1,745

(USI Green PC, from United Solutions) to \$2,799 (Micron 466VL Magnum CD). While the most expensive system of the group, the Magnum CD was also the best-equipped, with 16MB of RAM and a double-speed CD-ROM drive.

The key point is that you don't have to settle for a poor-performing computer that doesn't meet your needs. Buying a subpar Energy Star-compliant PC is akin to getting an air conditioner that's a miser on electrical usage but can't meet its cooling requirements—and leaves you sweating. Our advice: Start with a PC that meets your needs, and then make sure its power conservation features do, too.

The typical PC in this roundup came with local-bus video, a 486DX/66 CPU bolstered by 256K of external cache, a 340MB hard disk, and an accelerated graphics controller; in other words, more than enough processing power to satisfy all but the most ardent power users. Two units stood out from the pack. If you depend on your PC for fast Windows work, look at the Micron 466VL Magnum CD, which was easily the best Windows performer. If your computing revolves around DOS, check out the HiQ 4DX66 Green PC System, which was the best DOS performer.

Seven of the systems in this lineup are housed in at least mini-tower cases; the rest are in either desktop or slimline cases. The PC&C Iguana EG-2000 system is in a class by itself: This mini-desktop uses Pico

HIGHLIGHTS

Energy Star PCs

ENERGY STAR, the EPA's program to reduce the amount of power PCs use, has the potential to reduce pollution, save billions of dollars, and open up new ways of computing by allowing all-night operation. An Energy Star-compliant PC uses no more than 60 watts in standby mode; no more than 30 watts is consumed by either the system unit or the monitor.

THE 38 PCS WE TESTED show that you don't have to sacrifice performance or features to be green. The systems we reviewed should satisfy all but the most craven power users.

SAVINGS ADD UP QUICKLY. If you use your PC for 8 hours a day but always leave it on, a green PC could save about \$70 a year. If everyone used only green PCs, \$2 billion could be saved annually.

BUYERS GENERALLY KNEW ABOUT Energy Star-compliant PCs but weren't willing to pay extra for their benefits, according to a PC MagNet poll of about 400 computer users. Most felt the power-usage standard was just about right—neither too lax nor too stringent.

PRICES RANGED FROM A LOW of \$1,745—for the USI Green PC, from

United Solutions—to a high of \$2,799—for the Micron 466VL Magnum CD, which includes 16MB of RAM and a double-speed CD-ROM drive.

THE PC&C IGUANA EG-2000 is the thriftiest PC. The system uses just under 22 watts at full power and allows the motherboard battery to be used as a UPS.

MOST ENERGY STAR-COMPLIANT systems used the CMOS setup menu to make changes in the timing of sleep modes; 13 systems went further by adding an easier Windows utility.



EDITORS' CHOICE

Power's low-energy chip set and consumes just 21.8 watts at full power, 5.4 watts at idle.

Unfortunately, the PC&C Iguana's performance was as low as its power use, though the system has several redeeming qualities that transcend performance. It runs quieter than a traditional PC because it doesn't need a fan. Also, this system is like the Energizer Bunny: Turn it off or unplug it and it just keeps on going. The PC&C Iguana stays on because its motherboard's backup battery is powerful enough to act as an uninterruptible power supply.

For this review we introduce our Power Consumption rating, which measures the electrical drain at full power and at idle. Three PCs could not meet the system unit power-usage limit of 30 watts: the AMS InfoGold 486-66ES, Mega ECO-486DX2/66D+, and MicroFLEX-PCI/E. They did, however, come in under the 60-watt cap for total power consumption, which includes the power used by both the system unit and the monitor.

The rest of the units in this roundup fell into two groups. The majority of systems used between 100 and 150 watts at full power—an amount comparable to that used by traditional non-power-conserving PCs—and powered down in idle mode to meet the Energy Star requirement. Nine systems operated at full power at less than 30 watts for the CPU system unit; these units could have met the Energy Star requirements without powering down. Two systems—the IBM PC PS/1 and the PC&C Iguana EG-2000—were able to power down to less than 10 watts in sleep mode.

The typical PC and monitor together use about 150 watts of power, so a system that uses about one-third as much elec-

tricity obviously yields a dollars-and-cents pay-off. Beyond that, reducing power consumption could open up new avenues of computing, because it will allow us to run our computers night and day without

level of raw processing power, then you've succeeded in designing a fast PC that will speed up your work without speeding up the dial on your electric meter.

The Micron 466VL Magnum CD, from Micron Computer, proved itself to be a quality marriage of power and efficiency—evidence that you don't have to sacrifice power conservation for performance, or vice versa. This 486DX2/66-based system, which comes with a Conner 528MB hard disk and a Diamond Viper VL-Bus video card, took first place on our DOS-based processor and disk tests and on our Windows-based Disk WinMark, Graphics WinMark, and Winstone tests. A double-speed CD-ROM drive enhances an already stellar PC. And while the Micron Magnum did not fare as well on our DOS-based video tests as many other units in this roundup, its performance was certainly adequate.

Priced at \$2,799, the Micron Magnum may be the most expensive system tested in this roundup, but you'll get a lot for your money—including a double-speed CD-ROM drive and 16MB of system memory. The \$2,199 HiQ 4DX66 Green PC System, from HiQ Systems, was an-

other solid performer offered at a competitive price.

The 4DX2/66 HiQ Green PC, which used a 527MB Conner hard disk and a Promise VL-Bus hard disk controller, turned in the highest DOSmark score in this roundup and also performed well on our DOS-based disk and video tests. Its Winstone and Disk WinMark scores were strong too.

In building computers that meet the Environmental Protection Agency's Energy Star guidelines, PC makers had to keep a close eye on the design of their motherboards. Many of the machines in this roundup make good use of motherboard-integrated I/O, hard disk, and video subsystems. Such designs minimize power use but still allow the user to upgrade to alternate devices, such as new video or sound boards, should the need arise in the future.

Upcoming low-voltage processor designs from Advanced Micro Devices, Cyrix, IBM, Intel, and others bode well for energy-efficient computing. By the time you read this, the ceiling on possible performance with an Energy Star-compliant PC will have risen.

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fear of PC burnout or killer utility bills.

The obvious question is: Why leave the PC on at all? An ever-ready PC begins to fulfill the promise of personal computer as information appliance. This starts with 24-hour telephony operations such as taking phone messages, connecting for incoming faxes, and transmitting faxes when the phone rates are lowest. But this concept extends to having a PC always ready to receive commands from you remotely via a dial-in program for transferring files or reading e-mail. That

way, when you're on the road, you can always be a phone call away from your desktop PC and all that it contains.

The all-night PC can periodically scan the overnight news and financial market wire services and, at daybreak, prepare a summary based on your areas of interest. This computer summary would be more up-to-date than the morning newspaper, would have more depth than the radio or television news, and would be customizable to your specific interests. And what your PC finds on its late-night sojourn may have a great impact on your mood the next morning.

Acer and IBM were early adherents to this always-ready style of computing, but each missed the mark slightly. Two years ago, under the moniker "Personal Activity Center," the 386-based AcerPAC system

went beyond being a conventional PC by being among the first to power down when the computer was idle. More recently, the IBM PS/2 E combined a low-power system unit with four PCMCIA slots and an active-matrix color display (for more information, see the sidebar "Minimal Desktop PCs"). The reaction of buyers to each system was indifference. The AcerPAC was a 20-MHz 386-based unit and was viewed as underpowered; IBM initially charged \$7,000 for what amounted to a technology demonstration system, not a mainstream PC.

SHADES OF GREEN

Energy Star is the rare government program without dissenters because it offers something for everyone: Utility companies like it because Energy Star compli-

ance reduces the need to build new power plants. Computer and monitor makers—240 vendors so far—like it because the systems require minimal extra work to design and engineer. Environmentalists like it because less electricity means less air pollution. But most of all, PC users love lower electricity bills.

How much you save depends on your system, your style of computing, and how much you pay for electricity. Based on a typical utility charge of 10 cents per kilowatt hour (the cost of burning ten 100-watt bulbs for an hour; see the accompanying chart), a typical Energy Star-compliant system used for 8 hours a day and left on for the remaining 16 hours costs \$78.84 per year—a savings of more than \$50. And almost \$70 a year can be saved if you assume that the PC is actually used for only 3 hours a day.

Powering down to 60 watts may not seem like much. After all, a hair dryer uses about 20 times as much electricity, but you probably use your hair dryer for only about 15 minutes a day. The savings add up only

Suitability to Task: Energy Star PCs

All 38 tested systems met the Energy Star requirement that a total system consume 60 watts or less when powered down. Some units used less power and offered a high level of performance as well.

The **DOS applications** score reflects a system's ability to run DOS software efficiently. *Excellent* systems are those that earned top DOSmark scores on our benchmark tests and can run TSRs and memory-intensive DOS applications.

Windows applications is a more demanding category; the rating indicates how well a system will operate Windows software. This score takes into account system hardware and benchmark test results, including Graphics WinMark and Disk WinMark test scores and the score each system earned on Winstone 94, Version 1.0.

We also give weight to the hardware factors germane to a system's design, such as the maximum RAM a system allows, which is especially important for current and future Windows use. We also take into account a system's hard disk options and the diagonal size of its monitor

Those systems with *excellent* ratings in this category posted stellar processor scores and contained top-flight video controllers and fast hard disks, as evidenced by their excellent Graphics WinMark and Disk WinMark scores. Fewer systems had *excellent* ratings in this category than in our DOS applications category, since few systems perform as well under Windows as they do under DOS.

Expandability refers to a system's growth potential. We consider the ease of processor and external cache upgrades, hard disk options, maximum RAM installable, available drive bays and bus slots, and the presence of a flash-upgradable BIOS and a 16550 UART high-speed serial-port chip. The best systems have drive bays and slots to spare and easily upgradable processor/cache subsystems

We also tested each PC's **power consumption**. We gave half of the total weight to the system unit's power usage; we gave the other half to the total power usage, which includes that of the system unit and the monitor. Many PCs conform to Energy Star standards via unsophisticated methods. Most commonly, the CPU puts the monitor to

sleep. While this is effective, it is no different from turning your monitor off in terms of the amount of time the monitor takes to wake up. Because some monitors shut power off and take a long time to recover, power usage alone is not an indication of a monitor's power-saving efficiency. We therefore chose not to give any weight to the raw power consumption scores the monitors achieved.

► Product Name

SUITABILITY TO TASK	
DOS applications	POOR
Windows applications	FAIR
Expandability	GOOD
Power consumption	EXCELLENT
VENDOR SERVICE & RELIABILITY	
Reliability	AVERAGE
Repair service	ABOVE AVERAGE
Technical support	BELOW AVERAGE

SERVICE AND RELIABILITY

For our 1994 Service and Reliability issue, we sent questionnaires to 17,000 subscribers; about half replied. Vendors for which we received at least 50 responses are rated above average, average, or below average in three areas:

Reliability scores indicate to what degree PC owners felt their systems met their overall expectations for consistent operation.

Repair service scores are culled from users who contacted the vendors to have their PCs repaired.

Technical support scores measure how well vendors' telephone support met respondents' expectations.

RECENT REVIEWS	
► Unleashing the Power of Pentium	
April 12, 1994.....	page 114
► Small Wonders	
March 39, 1994.....	page 110
► Application Servers: At Your Service	
March 15, 1994.....	page 277

Price/Performance Index: *Energy Star PCs*

When it comes to best value, the HiQ 4DX66 Green PC System is the winner among the Energy Star systems. Though this unit's price falls just under the average for this roundup, its performance was bettered by that of only two systems: the Micron 466VL Magnum CD—an Editors' Choice winner—and the MicroFLEX-PCI E, from Micro Express. The MicroFLEX, however, did not meet the 30-watt limit for the system unit.

The Micron Magnum's \$2,799 price, which is the highest of the bunch, keeps this system out of the top 25 percent in terms of bang for the buck, but this PC topped all of the others in the way of performance and features. At the other end of the price spectrum is the \$1,745 USI Green PC, from United Solutions. This PC will save you plenty of greenbacks, but its performance ranked just shy of average.

A couple of systems don't quite measure up on our price/performance index. The Unisys PW2 Advantage Partner ELI 4333 carries a price that places it in the costliest one-third of this group, and the system's near-the-

when you look at the big picture. A corporate MIS department that has 250 PCs could save from \$13,000 to \$17,500 a year—hardly pocket change. On the whole, the EPA estimates that personal computers waste about \$2 billion each year in electricity, primarily because about 40 percent of them are running full blast night and day—regardless of whether they are being used.

Given that there are about 100 million PCs—and tens of millions of new ones expected each year—this is a big opportunity to reduce power demand, air pollution, and cooling costs—and to save money. According to the EPA, if all the PCs in the United States complied with Energy Star requirements today, the power saved in a

bottom-of-the-barrel performance couldn't redeem it.

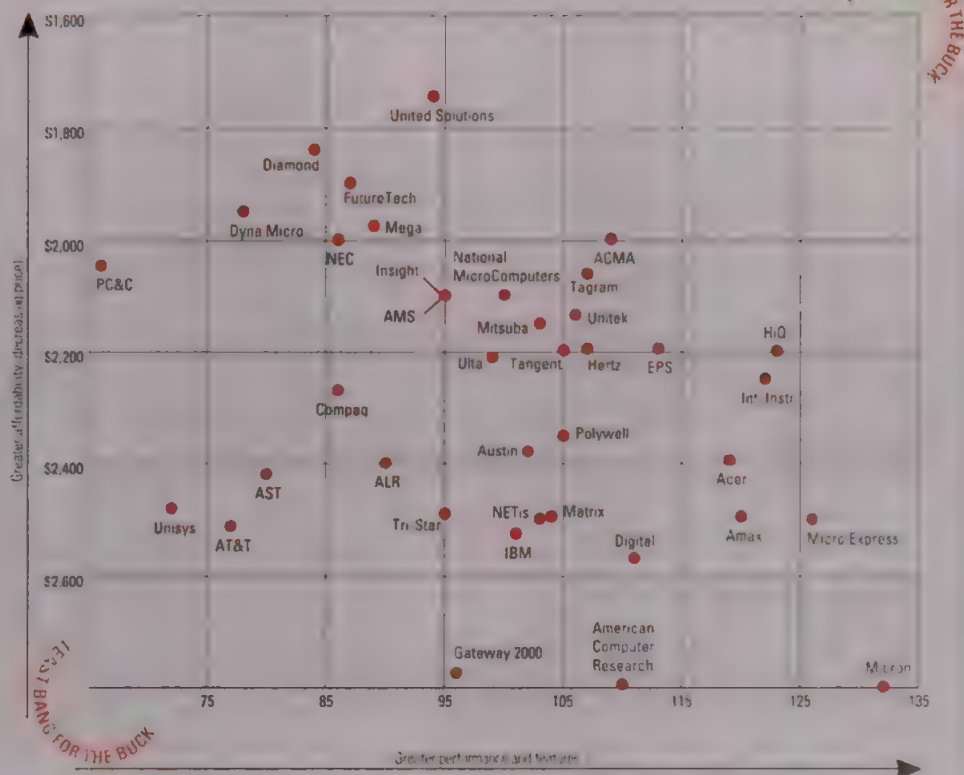
THE DATA POINTS

Our benchmark test scores account for 66 percent of a system's performance/features score. Ten percent of

each score is based on a system's power efficiency. Features such as monitor size, upgrade capability, and warranty account for the remaining 24 percent. The price for each unit is its list price, as reported in the fact file.

EASY TO ATTAIN

Because Energy Star compliance can be easily achieved with some simple alterations to a system's logic chip set and BIOS, PC vendors can generally offer it at no extra cost. In fact, many Energy Star-compliant PCs are actually less expensive than the models they replace. The bottom line is that by year's end you'll be hard-pressed to find an entry-level or



YOUR NEXT COMPUTER IF YOU CAN'T FIND

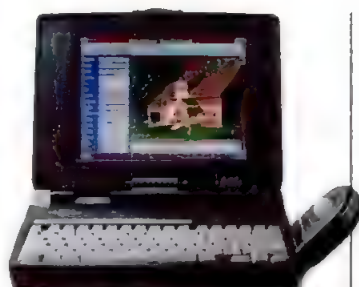


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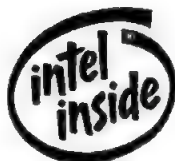
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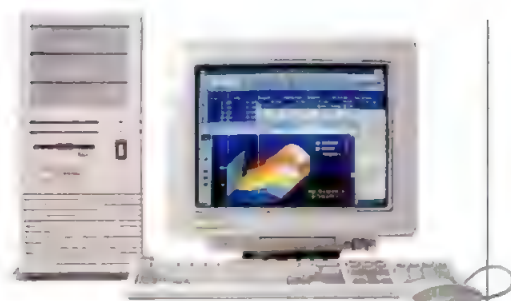
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♦
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♦
3.5" Diskette Drive
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What the Numbers Mean

High-end PC performance and being able to idle at 30 watts or less were not mutually exclusive items in this roundup of 38 Energy Star-compliant systems. Those that excelled combined ultrafrugal components with thorough design and engineering.

WINSTONE 94

The Winstone test confirmed that cache size is one of the weightiest factors influencing overall performance—after raw processor prowess—and dramatically affects a system's ability to run Windows applications. Those systems with strong processor scores and the most RAM scored highest on the Winstone test. The Micron 466VL Magnum CD, with the top processor score and 16MB of RAM, turned in the best Winstone score—60.3.

Extra main memory can also lift a Winstone score in a system with average processor performance. Of the 38 systems reviewed, 13 came with 16MB of RAM, and all 13 achieved the same rank on the Winstone test as on the processor tests, or better. Four of the 16MB systems made sizable improvements; most notably, American Computer Research's Solar Star 486BL/75 jumped from twenty-fourth place on the processor tests to eighth place on the Winstone test. Likewise, the NETis 486 VESA Green PC, a 486DX2/66 with a 128K L2 cache and a twenty-third-place processor score, placed ninth on the Winstone test, with a score of 47.4.

PROCESSOR

In this roundup, we saw wide performance swings among systems built around the same processor. Unlike the situation in most roundups, where systems' memory and cache sizes are generally equivalent, these green PCs had wide variations in their basic configurations. To meet the government's Energy Star limits some vendors shipped their systems with less cache, RAM, or both.

Among the 38 units we reviewed,

most used Intel 486DX2/66 CPUs. But just under one-third of the entries shipped with processors slower than 66 MHz—mostly DX2/50s and DX/33s. There was also one IBM Blue Lightning 25/75 MHz-based unit, American Computer Research's Solar Star; one Cyrix Cx486DX40-based entry, the Diamond Technologies' DT 486DX40 E-Star; and even one 486SX/33, the Compaq Deskpro XE 433s M270/w.

Processor scores for the 26 DX2/66 units ranged from a high of 45.9 (from the Micron Magnum, which uses Intel's SL-enhanced version of the DX2/66 CPU) to a low of 30.3 (produced by the NEC Ready 466es). The NEC model may simply have a less efficient motherboard design and supporting chip sets than the Micron unit, which is based on the fast Micronics VL-Bus X30 motherboard. One factor definitely made a difference: Micron's system came with 256K of L2 cache, while the NEC system had none.

The Micron unit also had 16MB of RAM, where the NEC model had 8MB, but memory size does not affect our processor tests. After motherboard and chip set design, cache size is what matters. Each of the top 18 performers on our processor tests—all 486DX2/66-based units—had an 256K external cache. Systems with less cache took noticeable performance hits.

GRAPHICS WINMARK

All graphics chips being equal, processor performance alone will make or break a system's Graphics WinMark score. But few graphics chips are equal, and for Windows performance, few can match Weitek's Power 9000 chip set. In the current roundup, it remains the ruling force in Windows video perfor-

mance.

Powered by the Weitek chip set, the Micron Magnum, the first-place system on our processor tests, held the highest Graphics WinMark score (16.1 million pixels per second). Micro Express's MicroFLEX PCI/E, another strong processor performer with a Weitek chip, snatched the second-highest Graphics WinMark score (15.0 million). Both systems' scores were well ahead of the third-place finisher, the Tangent VLe 466. It actually had a better processor score than the Micro Express unit, but the Tangent VLe used the Tseng ET4000/W32 graphics chip, which contributed to its still-admirable Graphics WinMark score of 12.6 million.

The Mega ECO486DX2/66D+, with a low processor score of 30.7, surprisingly earned a fourth-place Graphics WinMark of 11.7 million with the aid of the Weitek P9000. Also pulled up from the processor ranks was the Gateway 2000 4DX2-50V; thanks to its P9000 chip, it managed a Graphics WinMark score of 10.5 million.

Do keep all Graphics WinMark scores in perspective by noting each system's Winstone score. And unless Windows is your mainstay, think twice about any system with a P9000 chip. As good as the P9000 chip is at Windows, it falls short on DOS VGA functions. Every board carrying the P9000, including the famed Diamond Viper—the card holding each of the four P9000s in this roundup—must also pack a separate VGA chip. Unfortunately, most graphics vendors choose to supplement the P9000s on their boards with inferior VGA chips. As costs for the P9000 come down (boards containing it are still among the most expensive), you should see a better VGA chip for your P9000 money.

DOS VIDEO

There are several chips you should consider if you frequently work in DOS. First among them is Tseng Laboratories' ET4000/W32. Systems with it turn out high DOS video scores and strong Graphics WinMark scores. The

chip's variability was revealed by the four units in this lineup with ET4000/W32s (all DX2/66s): the NMC Pro-System 466, the Tagram V-Line CD/Green, the Tangent VLe 466, and United Solutions' USI Green PC. Their Graphics WinMark scores ranged from 9.5 million to 12.6 million (the latter score was bettered only by systems with P9000 chips). And their DOS video scores ranged from 5,334 to a first-place 6,202, achieved by the Tagram V-Line.

With midrange Graphics WinMark performance but high DOS video scores, Cirrus Logic's CL-GD542X family is the most frequent choice within this roundup. In one of three forms—model 5424, 5426, or 5428—it came with 22 of the systems and crossed most processor boundaries. None of the systems with a Cirrus Logic chip scored below 4,000 on DOS video.

Another good all-around graphics chip is the S3 86C928. Only one surfaced in this lineup—in Polywell's Poly 486GPC, a 486DX2/66 that earned a solid Graphics WinMark of 11.5 million and a respectable DOS video score of 4,916. One Compaq QVision graphics chip turned up, in the 486SX/33-based Compaq Deskpro XE 433s M270/w. This unit's Graphics WinMark score of 8.4 million was on a par with many of the 66-MHz systems equipped with Cirrus Logic graphics chips. Its video score was somewhat lower in ranking, but so was its processor score, which largely accounts for the difference.

Only one chip represented in this lineup offers no advantage in either graphical environment: the Chips & Technologies F65530A. This chip is usually found in notebook computers, which is a fine place to find it. The one unit in this review with the chip, the 486DX/33-based PC&C Iguana EG-2000, turned in a last-place Graphics WinMark score of 1.2 million, and a video score of 1,695—among the lowest of the roundup.

DISK WINMARK AND DOS DISK

Since the disk tests in PC Bench and WinBench use the same file read and

write operations, in the same order, most systems wound up with similar rankings on both sets of disk tests. In this lineup, eight of the systems with top-ten Disk WinMark scores made up the top ten in DOS disk scores, and vice versa.

DOSMARK

Those systems with high processor and disk scores ranked at the top in terms of DOSmark scores. The only systems obviously missing, as they ranked highest in just about every other category, were those systems with below-average scores for DOS video. The Micron Magnum had more number-one rankings than any other but placed twelfth for its DOSmark score; this is directly attributable to its P9000-based video card. As noted above, the P9000 chip is not a hot DOS video performer. Systems that used it emerged with weaker DOSmark scores than their processor and disk scores might have indicated. Conversely, each of the systems with strong DOS video got a boost in the DOSmark chart.

POWER CONSUMPTION

Technically, to comply with the government's Energy Star specification, a system unit and monitor must use 60 watts or less combined. We tested the CPU and monitor separately, so you can see which components are the most efficient.

In general, monitors use more power than CPUs when in use, and less power than CPUs when not in use. CPUs have less circuitry to support than monitors, but must support certain circuitry even when idle in order to avoid total system shutdown. Monitors can drop into a higher state of sleep or even turn off entirely, to be aroused by the CPU when needed. More than half of the monitors in this review draw less than 1 watt when not in use; most register 0 watts, indicating complete or virtually complete inactivity. Because they are turned off, these monitors are also likely to take the longest to resume functioning.

In certain cases, a monitor's total lack of power use has little to do with the monitor and everything to do with the CPU. Some new monitors control their own power consumption, as in the case of the Nanao FlexScan F340i-W bundled with three of the systems: American Computer Research's Solar Star, the HiQ 4DX66 Green PC System, and the Tri-Star ESPC DX-2. It automatically drops into a deep but readily aroused sleep mode when it senses a blank screen like that produced by any Windows screen-saver program. Most monitors in this review are not so smart; they rely on the CPUs to turn them off when not in use. While this allows just about any system to comply with the 60-watt total power limit, in most cases it is not very convenient for the user: Reactivating the monitor takes as long as if it had been manually turned off. (For more information on monitor power management and green monitors, see "14- and 15-Inch Monitors: Through the Looking Glass," *PC Magazine*, March 15, 1994.)

Energy-efficient monitors like the Nanao, however, have relatively quick response times, and they still reach extremely low power-consumption levels of 4 watts or less. Bear in mind that you can buy a green monitor and still not receive its response-time benefits if the paired CPU takes the power-off approach to making its monitor green. For instance, the HiQ Green PC will turn off any monitor used with it, so there is no point in pairing it with a "smart" monitor like the Nanao.

The making of a green CPU is not so straightforward. Unless the vendor starts with a motherboard designed to manage power effectively, controlled by system BIOS or a good power-management utility, it's difficult to keep within the 30-watt limit. Three of the systems we reviewed (all 486DX2/66 units) are energy-efficient on a systemwide basis, although their CPUs remain over 30 watts in their idle states. The Mega ECO486DX2/66D+ just about hits the mark, at 31.5. The other

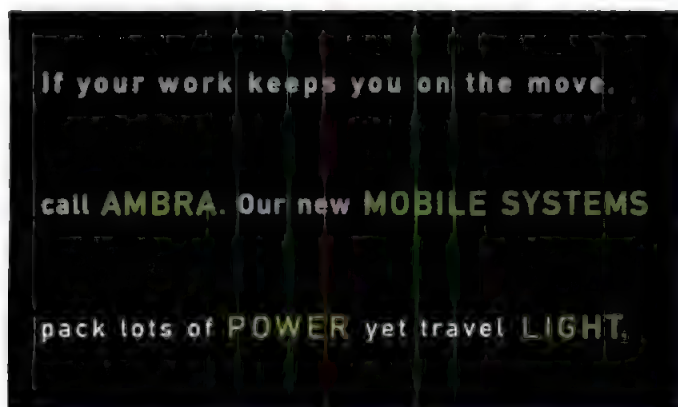
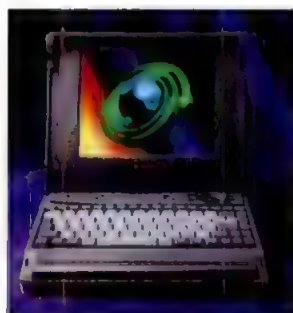
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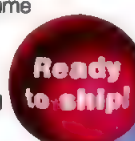
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two—Micro Express's MicroFLEX and American Multisystems' AMS InfoGold 486-66ES—rest at 36.8 and 40.2, respectively. Yet both systems utilize what can be termed "retro-green" cards to play the Energy Star game. Such cards will power-down an attached monitor, putting its power consumption at 0 watts and allowing just about any PC to turn green. The cards themselves demand extra power from the CPU, which primarily accounts for these two systems' relatively high CPU power consumption.

The most impressive CPU power management was demonstrated by the IBM PC PS/1, a 66-MHz system. The PS/1 went from 38.0 watts of power in full use to 0.8 watts when idle. The PC&C Iguana EG-2000 was the closest competitor, but that unit is a 33-MHz system in a case slightly larger than a notebook, with about as much circuitry to support.

—Analysis written by Tami D. Peterson

How We Tested

In preparing this issue, we used PC Bench 8.0 to predict processor, video subsystem, and disk performance using DOS applications. The DOSmark is a summary of those three results. We also used WinBench 4.0 to obtain Graphics and Disk WinMark scores, and we used the application-based Winstone 94, Version 1.0, to determine system performance under Microsoft Windows 3.1.

Winstone 94, Version 1.0, measures the time a PC takes to execute a set of application scripts that exercise 12 of the most popular Windows 3.1 applications. We normalize Winstone scores relative to a 386DX/25 Compaq Deskpro/M with 4MB of RAM, which has a Winstone score of 10.0.

The **processor** score reflects CPU, RAM, and RAM cache performance. It is based on a large instruction mix and either the floating-point coprocessor test or the floating-point emulation test, depending on whether a PC has a coprocessor.

The **Graphics WinMark** score is a measure of PC graphics performance under Windows. We run 66 different tests—divided into seven graphics test mixes—to evaluate each system's handling of the Windows GDI (Graphics Device Interface). These tests are based on extensive application profiling.

The DOS-based **video** score is a weighted harmonic mean of tests measuring 8- and 16-bit VGA write operations using text and graphics.

The **Disk WinMark** score reflects disk subsystem performance under Windows. The tests use different files and file operations in a blend based on extensive profiling of applications' disk usage.

The DOS-based **disk** score gauges the performance of a PC's disk subsystem, which includes the hard disk, disk controller, and any hardware or software disk caches. Operations performed include file reads, writes, creations, and deletions.

The **DOSmark** score is a composite rating derived from the processor, video, and disk scores. It indicates a PC's ability to run DOS applications.

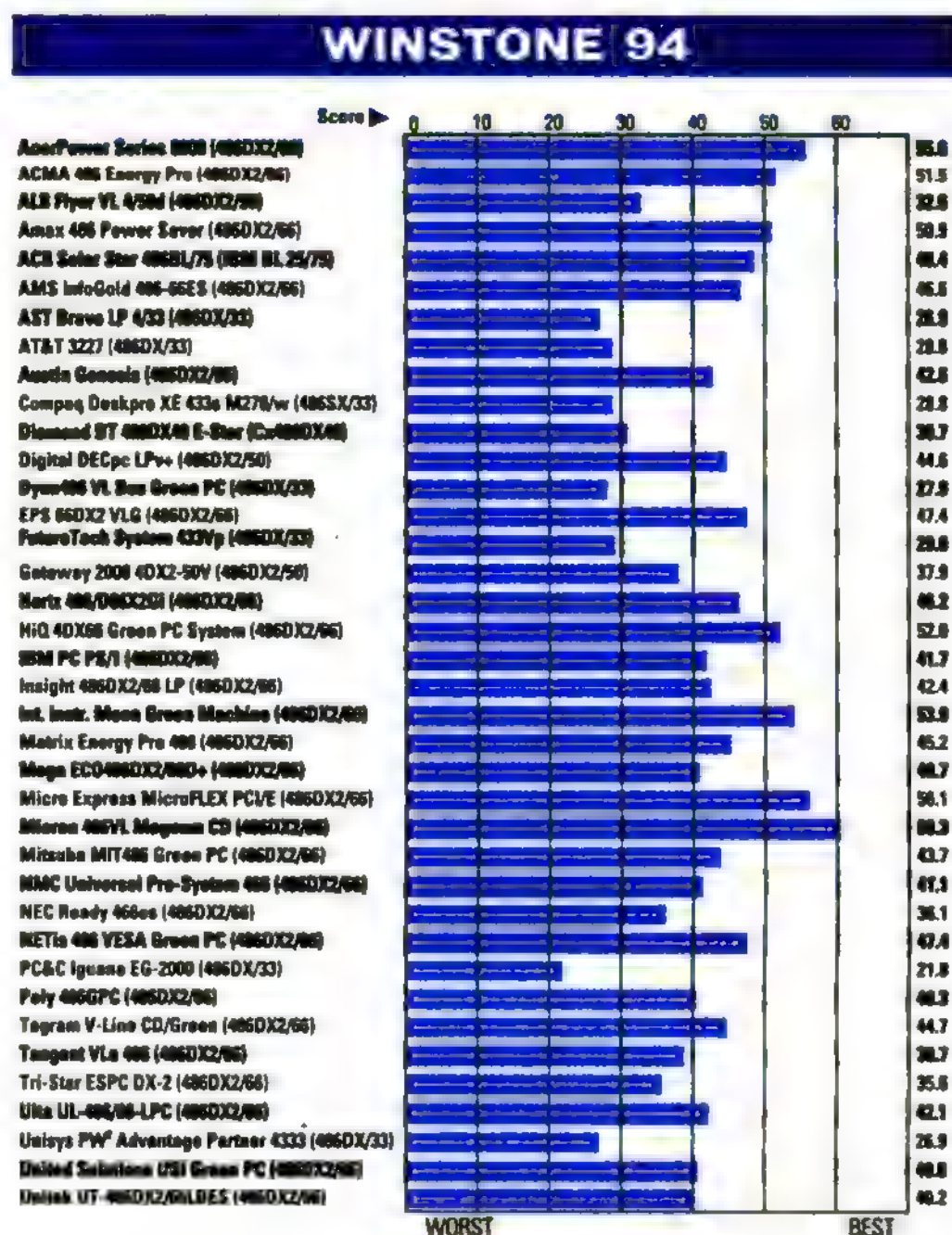
To test **power consumption**, we use the Dranetz Series 808 Electric Power/

Demand Analyzer, which is attached to each PC by a standard power cord. We measure power usage at 2-minute intervals for 16 minutes; readings are averaged to determine scores. We reported power consumption results to the nearest tenth of a watt.

Four scenarios are used: CPU full power, CPU standby, monitor full power, and monitor standby. To ensure that the Dranetz system derives its readings from power consumed by only the CPU or monitor, we plug monitors into a separate power source under all test conditions. During full-power tests, power management features (including screen savers) are disabled; during conservation tests, power management features are enabled.

During CPU full-power tests, we stress the CPU and keep the hard disk spinning by running our notebook battery-test program, ZDigit 2.0. With the CPU in standby mode, there is no keyboard or mouse activity. To ensure that power readings begin when the machine is in standby mode, we wait for the system's display to darken and for the CPU's power usage to stabilize.

We then perform the equivalent of these tests on the monitors. While systems are under full operation, with the ZDigit software running and the monitor brightness set at maximum, we measure each monitor's power consumption. During full-power tests, monitors are plugged directly into the Dranetz test system. During standby-mode tests, each monitor's power cord is plugged into the back of the base system unit—if recommended by the vendor as part of its power conservation strategy. In those cases, the Dranetz monitor reading is made via a spliced cable.

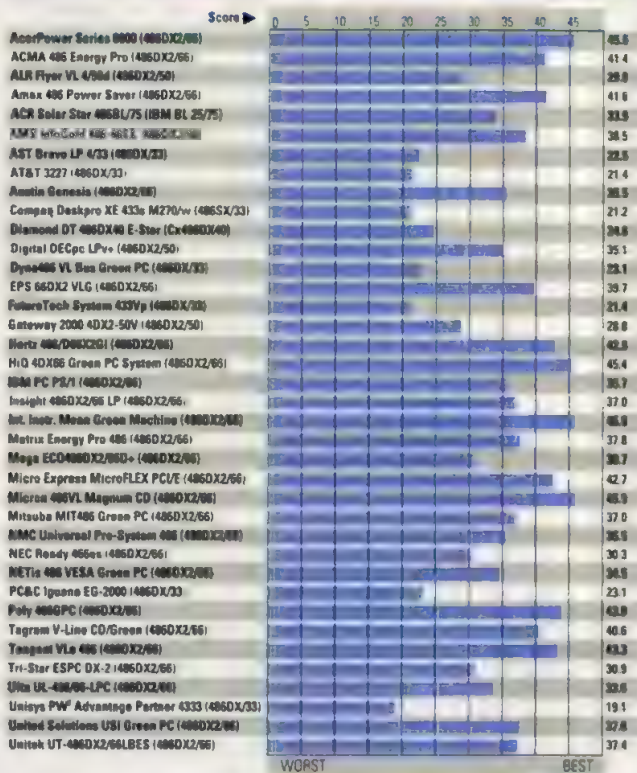




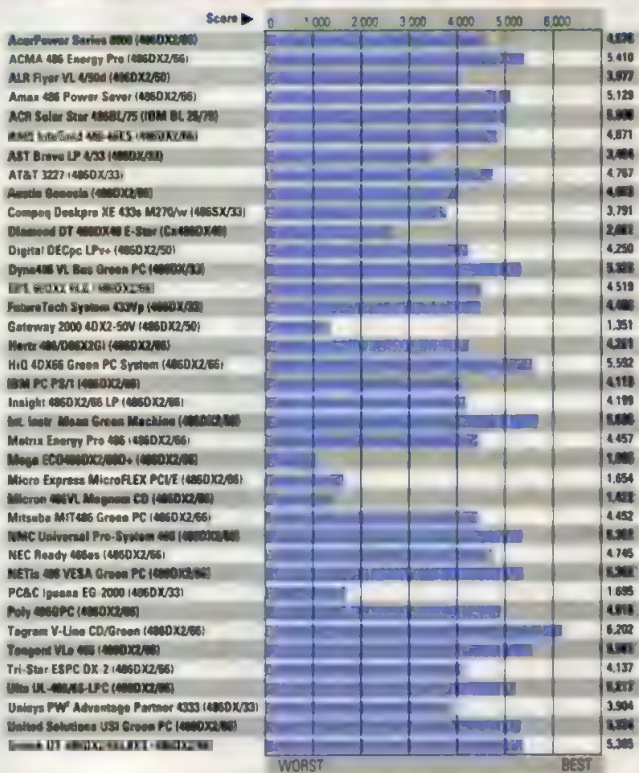
Benchmark Tests: Energy Star PCs

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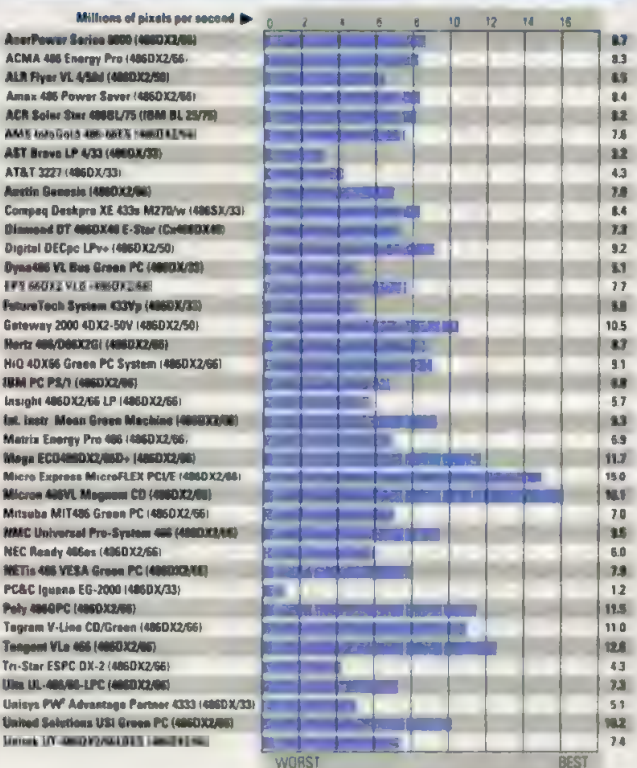
PROCESSOR



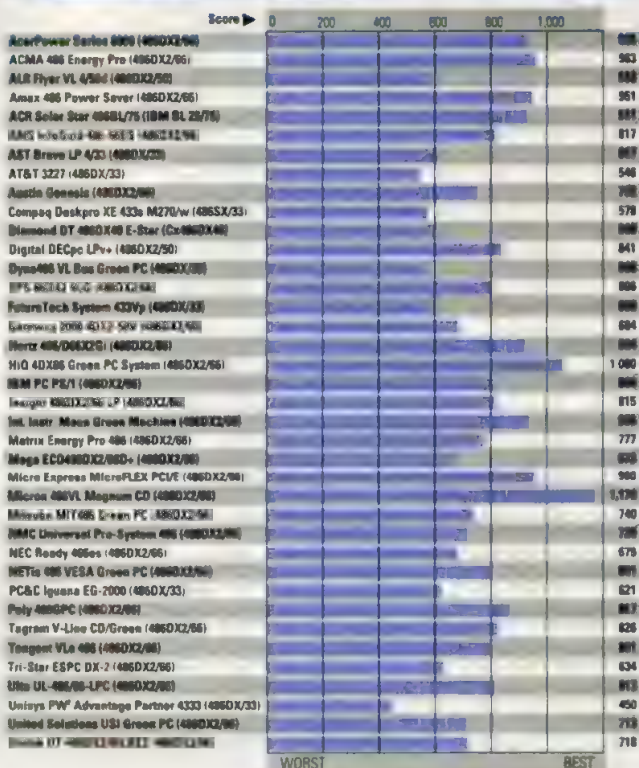
VIDEO



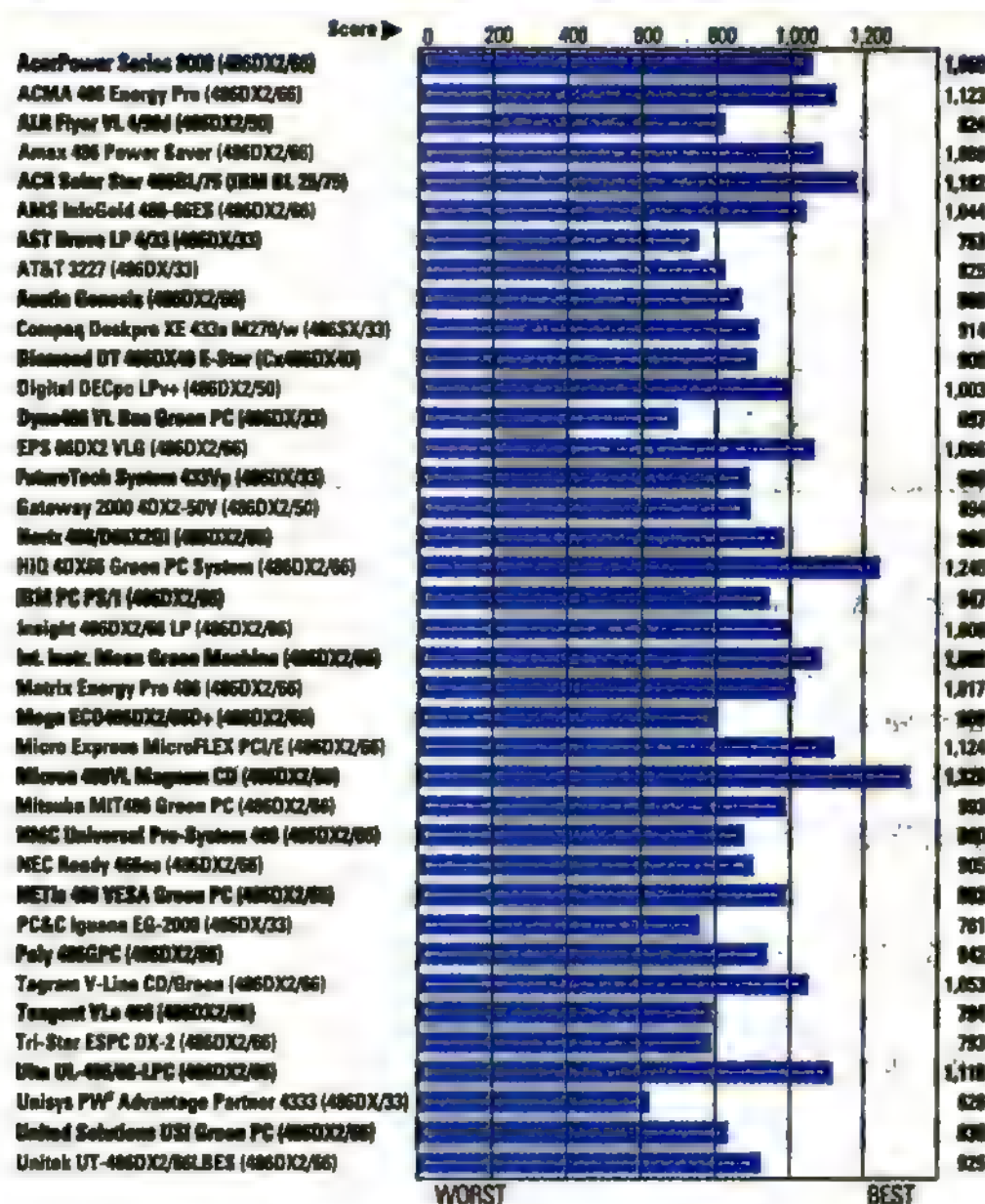
GRAPHICS WINMARK



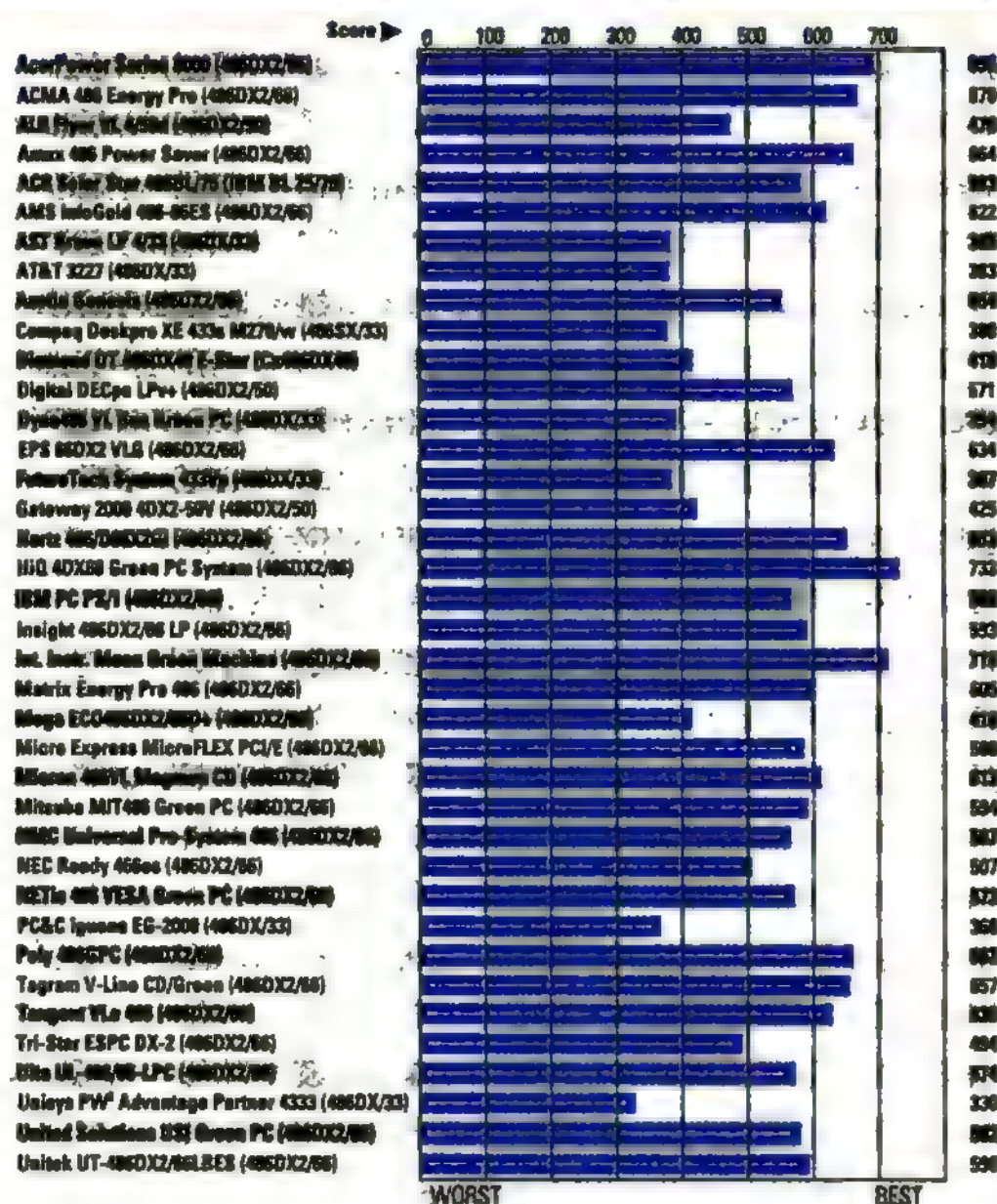
DISK WINMARK



DISK



DOSMARK



midrange PC that is not Energy Star-Compliant. The Energy Star movement gives vendors not only an effective way to save money for users but also a way to compete in Europe, where energy conservation is more of a national priority than it is in the United States.

What are the chances of an Energy Star-compliant Pentium system? Northgate will likely be the first to offer Pentium performance and power conservation in one package. The Elegance P60-ES uses less than 30 watts at idle. The Pentium CPU runs at 5 volts and uses 16 watts—about four times as much as today's low-voltage CPUs, such as Intel's 3.3-volt 100-MHz DX4 processor, which uses 4 watts at full power. The DX4, however, is expected to be a more popular choice in filling the performance gap between Pentium and 66-MHz 486 CPUs. And most notebooks are thrifty enough to meet the Energy Star requirements whether in or out of power-saving mode.

While the trend toward less power consumption by components is important, the advent of 3.3-volt CPUs is key. The 38 systems here all use either 5-volt or 3.3-volt

processors. The Cyrix Cx486DX40 in Diamond Technologies' DT 486DX40 E-Star and the IBM-made Blue Lightning clock-tripled (75-MHz) CPU in American Computer Research's Solar Star 486BL/75 are the only non-Intel processors here; those use 3.3-volt technology, which uses 60 percent less power than 5-volt technology. The other key advance in energy savings is System Management Mode (SMM), which, as a first step, allows the processor to reduce current to peripherals such as hard disks, graphics adapters, and input/output circuitry. Although each system operates differently, a deeper sleep mode generally follows after a preset period; this mode entails cutting off power to system memory so that only minimal functions are preserved. Most systems go a step further by slowing the speed of the system's bus and eventually stopping it altogether. Ideally, the system wakes up at the hit of a key or the touch of the mouse.

The beauty of Energy Star-

compliant units is that the timing of the power-down is up to the user. The most popular way of setting the power conservation is through adjustable controls in the CMOS setup menu. Thirteen of the represented vendors have added a Windows utility to make adjustments less intimidating and more intuitive; this also eliminates the need to restart the PC after changes are made.

The IBM PC PS/1, which is powered by a 486DX2/66, uses nearly 38 watts at full power but can drop down to less than a watt in idle. This unit uses a power management system that incorporates what the company calls Rapid Resume. In an easy-to-use dialog box, the monitor and hard disk can be set to shut down after 15 to 90 minutes of idleness. By contrast, the Dyna486 VL Bus Green PC uses an awkward standard text file of zeros and ones for setting peripheral time-outs.

What components use the most power? The system unit's motherboard and hard disk are

FEATURES PLUS

From April 11 through April 15, you can go on-line to discuss Energy Star PCs with key executives from Intel, the EPA, and Energy Star BIOS manufacturers. Type GO ZNT:EXEC from any Compu-Serve prompt.



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■ Intel Verified: for the Pentium™ OverDrive™ Processor ■ 2MB high-speed RAM ■ 107MB local bus IDE hard drive with 32K cache ■ 3.5" 1.44MB floppy disk drive ■ Diamond SpeedStar Pro Windows-accelerated local bus video with 1MB RAM. (16.7 million colors) ■ ZEOS 14" 1024 x 768 NI SVGA color monitor, .28mm dot pitch ■ Microsoft DOS 6.2 with Enhanced Tools	■ Intel Verified: for the Pentium™ OverDrive™ Processor ■ 4MB high-speed RAM ■ 214MB local bus IDE hard drive with 32K cache ■ 3.5" 1.44MB floppy disk drive ■ Diamond SpeedStar Pro Windows-accelerated local bus video with 1MB RAM. (16.7 million colors) ■ ZEOS 14" 1024 x 768 NI SVGA color monitor, .28mm dot pitch ■ Microsoft DOS 6.2 with Tools, Windows for Workgroups 3.11 & Microsoft Mouse	■ Intel Verified: for the Pentium™ OverDrive™ Processor ■ 8MB high-speed RAM ■ 426MB, 13ms local bus IDE hard drive with 128K cache ■ 2X CD-ROM drive, 3.5" 1.44MB floppy drive ■ Diamond SpeedStar Pro Windows-accelerated local bus video with 1MB RAM. (16.7 million colors) ■ ZEOS 14" 1024 x 768 NI SVGA color monitor, .28mm dot pitch ■ Microsoft DOS 6.2 with Tools, Windows for Workgroups 3.11 & Microsoft Mouse ■ Choice of Lotus Windows application	■ Intel Verified: for the Pentium™ OverDrive™ Processor ■ 16MB high-speed RAM ■ 528MB, 12ms local bus IDE hard drive with 256K cache ■ 2X CD-ROM drive, 3.5" 1.44MB floppy drive ■ Diamond SpeedStar Pro Windows-accelerated local bus video with 1MB RAM. (16.7 million colors) ■ ZEOS 14" 1024 x 768 NI SVGA color monitor, .28mm dot pitch ■ Microsoft DOS 6.2 with Tools, Windows for Workgroups 3.11 & Microsoft Mouse ■ Choice of Lotus Windows application

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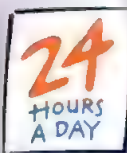


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- DOS, Windows for Workgroups, Mouse



486DX-33
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PACKAGE #2:

- 4MB RAM
- 214MB local bus IDE hard drive, 32K cache
- 3.5" floppy drive
- Windows-accelerated local bus video
- SVGA color monitor
- DOS, Windows for Workgroups, Mouse



486DX-33
\$1995
486DX2-66
\$2195

PACKAGE #3:

- 8MB RAM
- 426MB local bus IDE hard drive, 128K cache
- 2X CD-ROM drive, 3.5" floppy drive
- Windows-accelerated local bus video
- SVGA color monitor
- DOS, Windows for Workgroups, Mouse
- Choice of Lotus application



486DX-33
\$2143
486DX2-66
\$2343

PACKAGE #3MM:

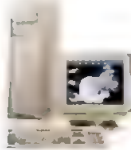
- 8MB RAM
- 426MB local bus IDE hard drive, 128K cache
- 2X CD-ROM drive, 3.5" floppy drive
- Multimedia upgrade: 16-bit sound card, stereo speakers
- Windows-accelerated local bus video
- SVGA color monitor
- DOS, Windows for Workgroups, Mouse
- Choice of Lotus application



486DX2-66
\$2695

PACKAGE #3 TOP GUN:

- 8MB RAM
- 256K SRAM system cache
- 528MB local bus IDE hard drive, 256K cache
- 2X CD-ROM drive, 3.5" floppy drive
- Diamond Viper local bus video card
- 15" SVGA color monitor
- 14,400 bps V32 bis send/receive fax modem
- DOS, Windows for Workgroups, Mouse
- Choice of Lotus application



Pantera 60
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Pantera 66
\$2995

PACKAGE #2:

- Intel Pentium Processor
- 8MB RAM, 256K cache
- 340MB local bus IDE hard drive, 128K cache
- 2X CD-ROM drive, 3.5" floppy drive
- PCI local bus graphics with 1MB RAM
- SVGA color monitor
- DOS, Windows for Workgroups, Mouse
- Choice of Lotus application
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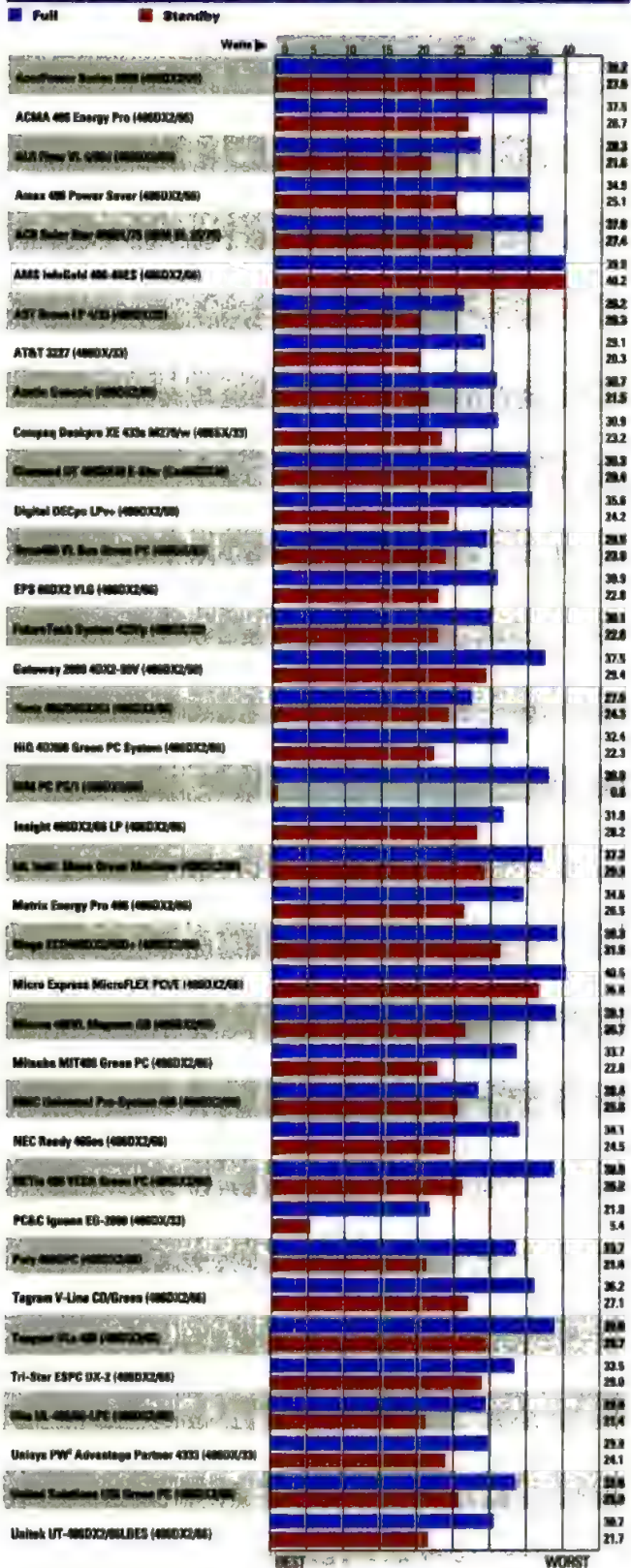


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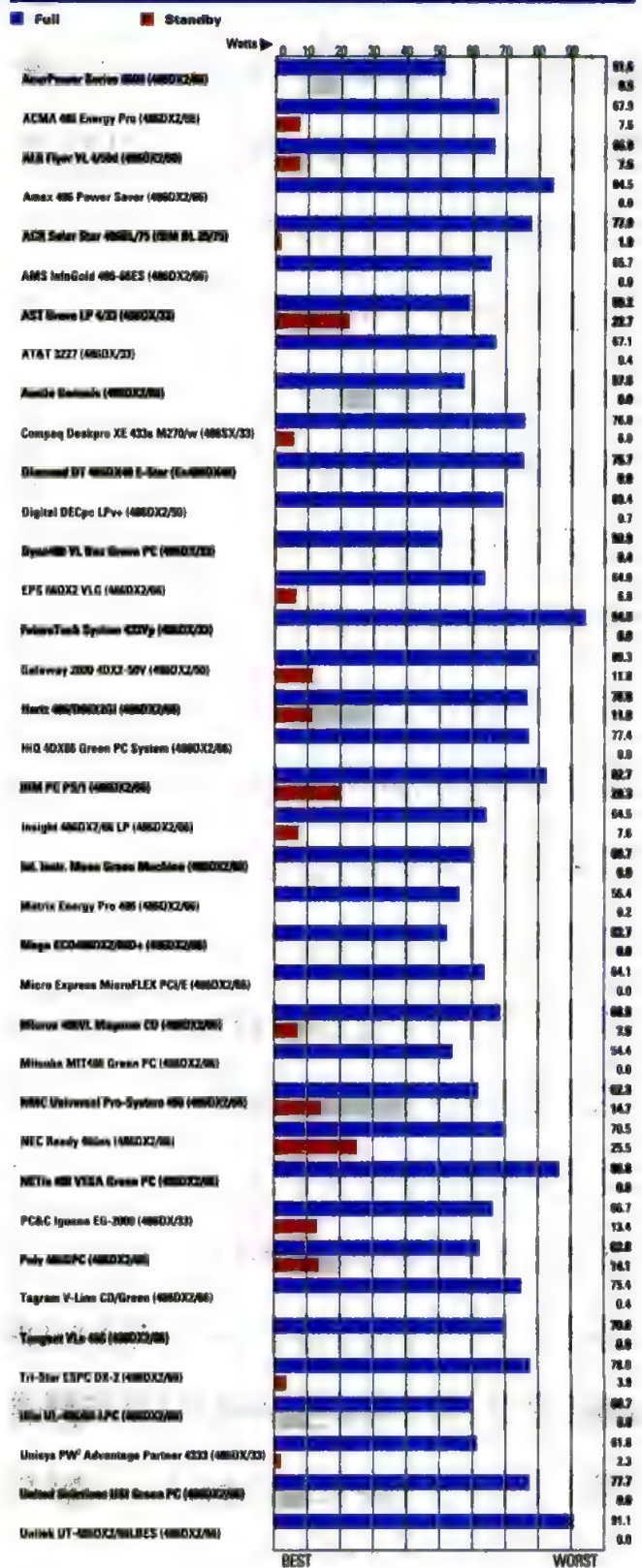
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CIRCLE 155 ON READER SERVICE CARD

SYSTEM UNIT POWER CONSUMPTION



MONITOR POWER CONSUMPTION





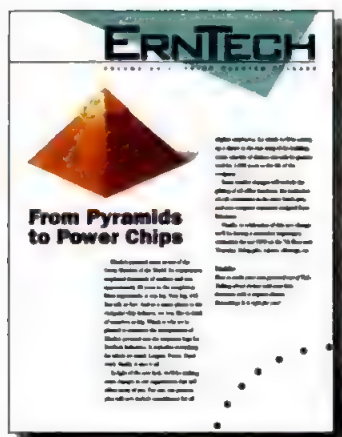
20 years.

100,000 men.

752 casualties.

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SO ADVANCED IT EVEN TURNS ITSELF OFF.



September 14, 1993
Nanao FlexScan F550h-W



FlexScan F550h

Nanao, the technical leader in monitors has done it again. In addition to being the top choice of today's CAD/CAM, DTP and Windows users, Nanao's award-winning FlexScan monitors now have a remarkable energy-saving system - PowerManager.

PowerManager works with all green computer systems including VESA DPMS (Display Power Management Signaling). But users don't have to own a new green computer in order to take advantage of the PowerManager to save energy. Our PowerManager works with any existing PCs with a screen saver software, including Windows 3.1 and After Dark. Activating when the blank screen of the screen saver appears, PowerManager cuts operating power to less than 8% of total consumption. It also automatically powers the monitor down



to a stand-by mode when the computer is turned off. The PowerManager can save users as much as \$63 per year on utility bills (Source: E Source). PowerManager has placed Nanao at the forefront of the Environmental Protection Agency's Energy Star Program.

PowerManager is now the standard feature of our 15", 17", 20" and 21" monitors. All Nanao energy-saving monitors feature superior Invar Shadow Mask and Trinitron CRTs with non-flicker ultra-high resolution. Their ergonomic features include compliance with MPR-II/TCO low radiation emission standards and anti-reflective treatments. Best of all, they can power down. So when you're not working, neither are they.

Nanao FlexScan monitors. Intelligently designed. Incredibly useful. And now, built to help protect our environment by reducing energy consumption.

*The Energy Star emblem does not represent EPA endorsement of any product or service.



FlexScan T660h

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CIRCLE 283 ON READER SERVICE CARD

COVER STORY

Energy Star PCs

obvious culprits, and these are the parts that are powered down first. Peripherals such as network cards or sound cards can add as little as a couple of watts or as much as 23 watts. (See the sidebar "Expansion Cards and Power Use.")

WAKE-UP TIME

A good indicator of how well a system deals with powering down is how long it takes to wake from sleep mode. After all, if the PC goes into a coma that takes 15 seconds to emerge from, you're likely to spend a lot of time tapping your fingers.

A system can awaken from sleep mode only as fast as the monitor can. Look for power management modes that send just enough juice to warm the electron gun instead of cutting off all power to the CRT. This way, the monitor can recover quickly.

that keeps the electron gun warm.

The biggest outcome of the Energy Star effort may paradoxically be that we will turn a system on when it is initially configured and leave it on—always. The PC will move in and out of power-saving mode as the amount of computing wanes and waxes, much the way the Hewlett-Packard OmniBook subnotebook does.

A new generation of power saving PCs is in the works. Call it Energy Star: The Next Generation. It will attack several areas. The biggest payoff is likely to come from improving a PC's power supply. Today's best power supplies are only about 35 percent efficient; more than half of the energy is converted into heat, which must be pulled away from the system by a power-draining fan, further exacerbating the problem. Seventy-five percent efficiency is the current goal.

Hard disks are likely to continue to be more efficient and to offer larger capacity as time goes on. But don't expect much on the monitor front, particularly for those larger than 17 inches, which use several hundred

watts at full power. Low-power LCD screens are still years away from being competitively priced. Advances such as 3.3-volt technology and self-refreshing DRAM could help, especially when used in computers that have large amounts of system memory.

What will happen soon is a move to PCMCIA peripherals on the desktop. The low-power requirements of these credit card-size modems, LAN cards, and other PCMCIA devices make them easy on a notebook's battery and will make them an attractive means of saving power on the desktop. By the end of the year, most major PC makers will offer desktops with PCMCIA slots.

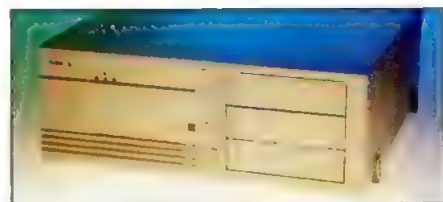
The direction is clear: The Energy Star movement is just the beginning. Technology over the next few years can produce a powerful PC that uses 15 watts in idle mode, including the monitor. The result could be a PC that handles multimedia, answers the phone, and keeps an eye out for faxes and interesting news—and one that will use about as much electricity as the little light bulb in your refrigerator.

Acer America Corp.

AcerPower Series 8000

The 486DX2/66-based AcerPower Series 8000's strong Windows and DOS capabilities make it worth a long look, particularly in view of the machine's \$2,395 price.

This well-built unit includes six drive



bays and a 345MB Maxtor hard disk, and it had a surprising amount of room for a standard desktop. Two VL-Bus slots and an IDE disk controller are integrated on the motherboard.

Power consumption for this system is managed through the system's setup utilities; these include power-down timing and allow the user to select what type of activity will wake the system up (video, hard disk, or bus). Separate power con-

servation settings control the monitor, CPU, and hard disk. In standby mode, the system unit's power usage dropped from 38.2 watts to 27.6 watts, and the monitor's fell from 51.6 watts to 0.5 watts.

The AcerPower proved to be a powerful performer. Strong DOS disk and processor scores contributed to the unit's third-place DOSMark score. The machine's Winstone score was in the top three of this roundup, and its Disk and Graphics WinMark scores were quite respectable as well.

The AcerPower is a solid machine that offers high performance at a modest price.—Bill Flanagan

► **AcerPower Series 8000.** List price (tested configuration): \$2,395. Processor/

Energy Star: PCs That Add to the Bottom Line

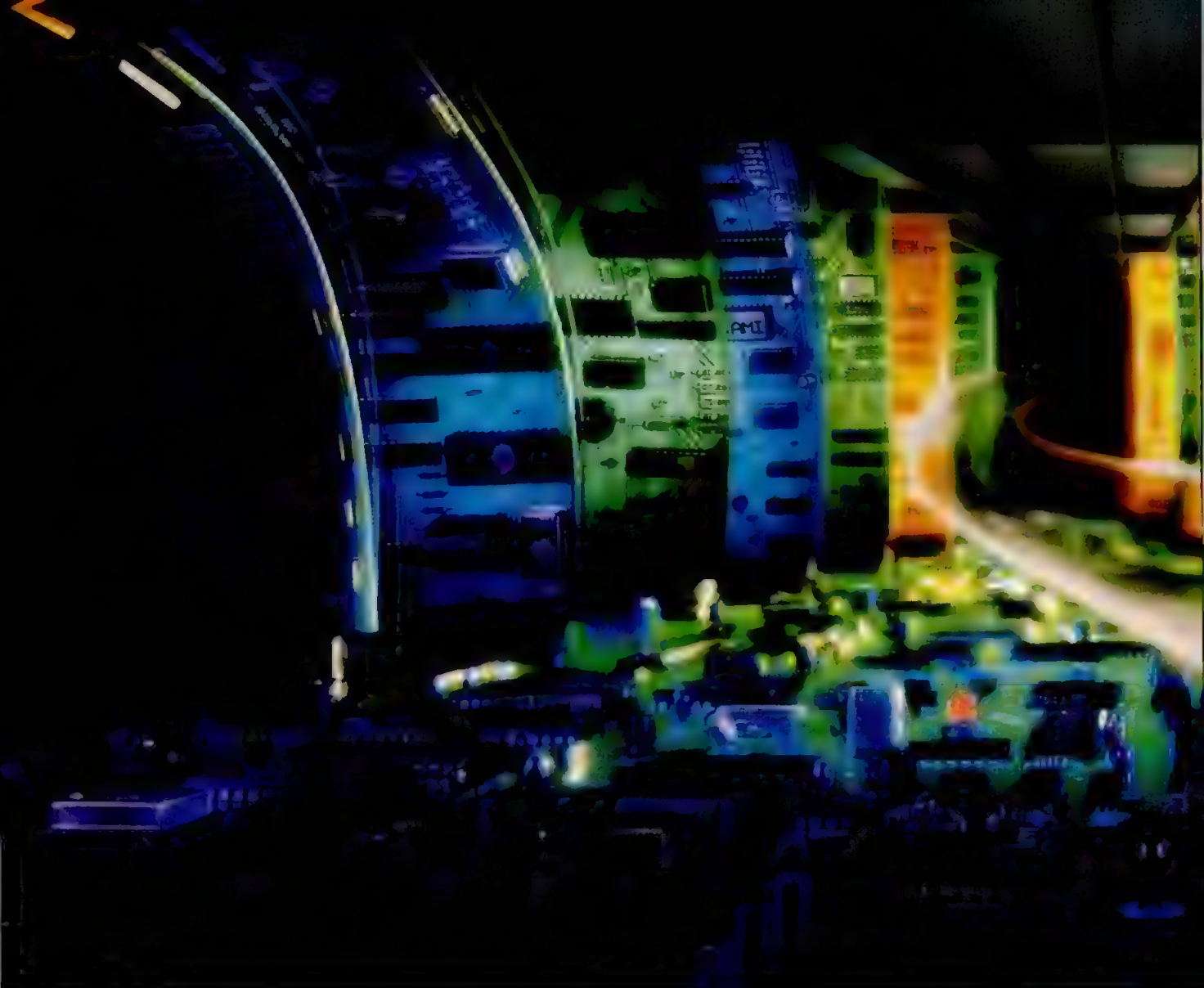
	If every day the unit is used in full-power mode (150 watts) for	And used in Energy Star mode (60 watts) for	Then the annual electrical cost* will be:
Traditional PC	24 hours	—	\$131.40
Energy Star-compliant PC	8 hours	16 hours	\$78.84
Energy Star-compliant PC	3 hours	21 hours	\$62.42

* Based on a charge of 10¢ per kilowatt hour

Those systems that cut all power to the monitor will take 15 seconds or longer to bring back a picture. In this area, Nanao leads the way by using a three-level power-saving system in which the power-conserving mode drops power consumption to a small fraction of what the system uses at full power. For example, the 15-inch F340iW monitor found on American Computer Research's Solar Star and the Tri-Star ESPC DX-2 uses less than 4 watts in idle mode, down from a peak power wattage of about 78—which amounts to a 95 percent savings. Each monitor is able to recover in a second from the deepest sleep mode.

For those not interested in buying a new monitor, there is an after-the-fact Energy Star possibility. MonitorMiser, from Technology Marketing Partners (415-940-7800), has an add-on controller (\$79.95) that can shut off any old monitor by keeping track of keystrokes. The cassette-size box plugs into the keyboard and drops power consumption for the monitor to less than a watt if no keystrokes are detected. But because the system cuts power to the monitor, the monitor takes longer to revive than one

AcerPower Series 8000	
SUITABILITY TO TASK	
DOS applications	EXCELLENT
Windows applications	EXCELLENT
Expandability	GOOD
Power consumption	FAIR
VENDOR SERVICE & RELIABILITY	
Reliability	AVERAGE
Repair service	AVERAGE
Technical support	BELOW AVERAGE



Better performance

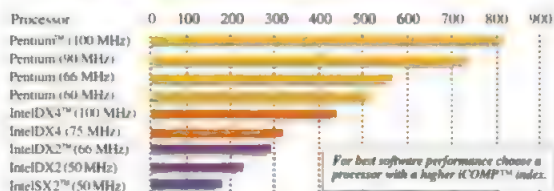


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*The Intel iCOMP™ Index of Relative Processor Performance**





across the board.

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So stop by your favorite PC reseller and ask to see the new Pentium processor-based systems. You'll find they start with the best-performing processor. But that's not where they end.

For more information and a list of the Pentium processor-based systems currently available, call 1-800-395-7009, Ext. 116.

intel®

CIRCLE 363 ON READER SERVICE CARD

memory: Intel 486DX2/66, 16MB RAM, 256K external cache. Data storage: Maxtor 7345AT 345MB IDE hard disk with 64K cache, integrated disk controller. Display: Acer AcerGraph L28 VL-Bus-card video controller with 2MB DRAM; Acer AcerView 34T 14-inch monitor with a 60-Hz refresh rate at 1,024-by-768. Software: DOS 6.0, Microsoft Windows 3.1. Acer America Corp., 800-368-2237, 408-432-6200; fax, 408-922-2953.

Circle 445 on reader service card

ACMA Computers Inc.

ACMA 486 Energy Pro

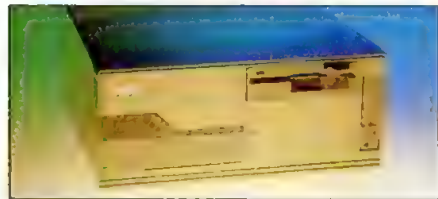
The \$1,998 ACMA 486 Energy Pro is a solid desktop PC that combines 486DX2/66 power, above-average performance, and Energy Star power efficiency at an affordable price.

ACMA 486 Energy Pro	
SUITABILITY TO TASK	
DOS applications	EXCELLENT
Windows applications	GOOD
Expandability	FAIR
Power consumption	FAIR

The system's power management is operated through the AMI BIOS and has three timed options (motherboard, screen

saver, and suspend mode), each of which can power-down after from 1 to 255 minutes of idleness. In standby mode, the system powered down from 37.5 watts to 26.7 watts, and the monitor's power usage dropped from 67.9 watts to 7.6 watts.

The ACMA Energy Pro performed well on our benchmark tests, finishing in



the top ten in six of seven categories. (It placed seventeenth on our Graphics WinMark tests—still above average.) With its Cirrus Logic-based video subsystem, this unit posted better scores on our DOS-based video tests than on our Windows-based ones. Strong showings on both DOS disk and Disk WinMark tests were due in part to the system's caching controller with 4MB of disk cache.

The ACMA Energy Pro offers a strong combination of price, performance, and power savings.—BF

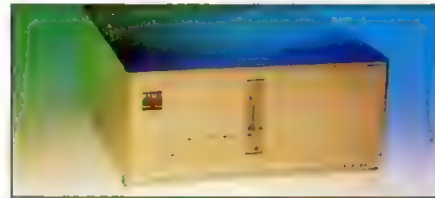
► **ACMA 486 Energy Pro.** List price (tested configuration): \$1,998. Processor/memory: Intel 486DX2/66, 8MB RAM, 256K external cache. Data storage: Conner CP30204 212MB IDE hard disk with 256K cache, Promise DC4030VL-2 VL-Bus-card disk controller with 4MB cache. Display: Genoa 8500VL VL-Bus-card video controller with 1MB DRAM; MAG DX15F 15-inch monitor with a 120-Hz refresh rate at 1,280-by-1,024. Software: DOS 6.2, Microsoft Windows 3.1. ACMA Computers Inc., 800-786-6888, 510-623-1212; fax, 510-623-0818.

Circle 446 on reader service card

American Computer Research Inc.

Solar Star 486BL/75

The \$2,795 price of American Computer Research's Solar Star 486BL/75 is relatively high, and the performance of this 75-MHz IBM Blue Lightning-based unit doesn't quite dust the competition, but its



unique power management meets Energy Star requirements and can be customized to yield an energy-efficient workday.

Although the Solar Star made a strong showing on our DOS disk tests and on our Winstone test, its 75-MHz CPU was generally outperformed by those of a number of similarly configured 486DX2/66 units. In standby mode, the system unit powered down from 37 watts to 27.4 watts, the monitor from 77.9 watts to 1.9. This machine's power management software, however, is unique among the 38 PCs tested in that it offers four different settings that correspond to different times of day; this way, the system can be customized according to your work habits. At peak hours the system will time-out less often; during slower periods, more often. There are also two user-definable hotkeys—one to put the system to sleep and one to disable power management features.

Unfortunately, good power management software is not enough to compensate for the high price and average performance of the Solar Star.—BF

► **ACR Solar Star 486BL/75.** List price (tested configuration): \$2,795. Processor/memory: IBM Blue Lightning 25/75, 16MB RAM, 256K external cache. Data storage: Seagate ST3390A 341MB IDE hard disk with 256K cache, Promise DC4030-

VL-2 VL-Bus-card disk controller with 2MB cache. Display: Genoa Systems WindowsVGA 24 8500VL VL-Bus-card video controller with 1MB DRAM; Nanao F340iW 15-inch monitor with a 60-Hz refresh rate at 1,280-by-1,024. Software: DOS 6.2, Microsoft Windows 3.1. American Computer Research Inc., 408-257-8998; fax, 408-257-9158.

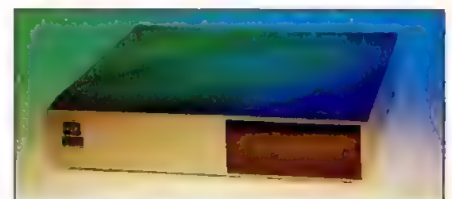
Circle 447 on reader service card

Advanced Logic Research Inc.

ALR Flyer VL 4/50d

At full power, the ALR Flyer VL 4/50d uses less energy than many systems do when operating in standby mode. Unfortunately the \$2,400 price is relatively high for the inconsistent performance this 486DX2/50 unit demonstrated.

The ALR Flyer VL's system unit used just 28.3 watts at full power (21.6 watts in



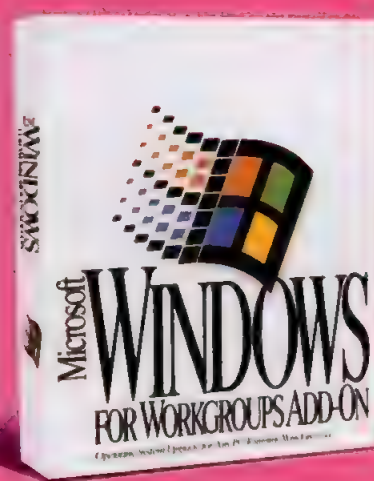
standby mode); the monitor powered down from 66.8 watts at full power to 7.6 watts in standby mode. The Phoenix BIOS controls power management and allows separate time-outs for workday and nighttime or nonworking hours.

The ALR Flyer VL's benchmark test performance was below average overall, and when compared with other same-chip units, its scores were inconsistent. The

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makes searching for files and loading Windows up to 100% faster.*

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Microsoft

*Performance figures may vary depending on configuration. Ziff Davis WinBench™ speed tests were average performance runs, 100 being baseline avg., based on a Zenith Z-note 425 Laptop/Intel 80386-based computer and an 80486-based computer (both uncompressed and compressed disk volumes used) with 4MB RAM, 200MB hard disk, 512 cache and IDE disk controller. Test was run using MS-DOS v. 2. Test converted by Ziff Davis. © 1994 Microsoft Corporation. All rights reserved. Microsoft and MS-DOS are registered trademarks and Windows, Windows NT and Microsoft At Work are trademarks of Microsoft Corporation. Novell and NetWare are registered trademarks of Novell Corp. In the 50 United States, call 800-426-9400. Customers in Canada, call 800-563-9048, outside the 50 United States and Canada, call your local Microsoft subsidiary or 016-936-5061.

ALR Flyer VL 4/50d	
SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	FAIR
Expandability	FAIR
Power consumption	GOOD
VENDOR SERVICE & RELIABILITY	
Reliability	BELOW AVERAGE
Repair service	BELOW AVERAGE
Technical support	BELOW AVERAGE

unit's Western Digital 340MB hard disk didn't help it on either the DOS disk or Disk WinMark tests: Its scores on both were below average. The system's Western Digital-controlled video subsystem made for a strong DOS video score, but as expected, the machine's Windows-based scores were only fair.

The ALR Flyer VL 4/50d demonstrates impressive power-conservation engineering, but there are systems in this roundup that offer better performance for less money.—*BF*

► **ALR Flyer VL 4/50d.** List price (tested configuration): \$2,400 (estimated). Processor/memory: Intel 486DX2/50, 8MB RAM, 256K external cache. Data storage: Western Digital AC2340-32H 340MB IDE hard disk with 128K cache, integrated WD90C33 VL-Bus disk controller. Display: Integrated VL-Bus video controller with 1MB DRAM; MAG DX15F 15-inch monitor with a 76-Hz refresh rate at 1,024-by-768. Software: DOS 6.2, Microsoft Windows 3.1. Advanced Logic Research Inc., 800-444-4257, 714-581-6770. Circle 448 on reader service card

Amax Engineering Corp.

Amax 486 Power Saver

It's easy to like the Amax 486 Power Saver. This 486DX2/66-based tower unit, priced at \$2,495, offers comprehensive power management and above-average performance; it even comes with two PCMCIA Type II slots.

The AMI BIOS setup is used to configure



the power-saving modes. The speed of both the CPU and VL-Bus can be slowed to 8 MHz; the serial port, display, and any peripheral plugged into the unit's auxiliary power outlet can have their power cut off, each after from 1 to 255 minutes of idleness. The system unit's power usage dropped from 34.9 at full power to 25.1 watts in standby mode, and the NEC 4FGe monitor shut off from a peak consumption of 84.5 watts.

On our benchmark tests, this unit—which used a Promise VL-Bus caching IDE hard disk controller with a 4MB cache, wired to a Conner 342MB hard disk—turned in one of the best DOSmark scores.

Packed with high-quality features and equipment, the Amax Power Saver is a good choice.—*Bruce Brown*

► **Amax 486 Power Saver.** List price (tested configuration): \$2,495. Processor/memory: Intel 486DX2/66, 8MB SIMMs, 256K external cache. Data storage: Conner CP30344 342MB IDE/LB hard disk with 64K cache, Promise Technology DC4030VL-2 VL-Bus-card disk controller with 4MB cache, PCMCIA-card drive with two Type II slots. Display: Genoa Systems 24 Model 8500VL VL-Bus-card video controller with 1MB DRAM; NEC MultiSync 4FGe 15-inch monitor with a 76-Hz refresh rate at 1,024-by-768. Software: DOS 6.0, Microsoft Windows 3.1. Amax Engineering Corp., 800-800-6328, 510-651-8886. Circle 449 on reader service card

American Multisystems

AMS InfoGold 486-66ES

With average performance and limited power management features, the \$2,099 AMS InfoGold 486-66ES does not get high marks in its CPU class for either speed or energy conservation.

The 486DX2/66-based AMS InfoGold mini-tower PC wears the Energy Star label because with its monitor powered down, total power consumption is less than 60

watts. The AMS InfoGold has a Green PC Control Card plugged into an expansion slot, allowing you to set the power-down to occur after from 7 to 56 minutes of idleness, in 7-minute increments. Delay time can be configured by setting a combination of expansion board jumpers and externally accessible DIP switches. In testing, the monitor's power consumption dropped from 65.7 watts to 0 watts, but the system unit's power consumption actually went up, from 39.9 watts to 40.2.

With benchmark test scores that were average for a DX2/66 PC, the AMS InfoGold proved to be competent but didn't earn any special recognition. The test system was equipped with a single-speed Sony CD-ROM drive that typified the entire system: It works, but it's slow.—*BB*

► **AMS InfoGold 486-66ES.** List price (tested configuration): \$2,099. Processor/memory: Intel 486DX2/66, 16MB RAM, 256K external cache. Data storage: Conner CF-30344 340MB IDE hard disk with 256K cache, Promise PTI PDC20230 VL-Bus-card disk controller, Sony CDU31A-02 CD-ROM drive. Display: Diamond SpeedStar Pro VL-Bus-card video controller with 1MB DRAM; InfoGold IG3000 14-inch monitor with a 60-Hz refresh rate at 1,024-by-768. Software: DOS 6.2, Microsoft Windows 3.1. American Multisystems, 800-888-6615, 408-524-9091; fax, 408-524-9099. Circle 450 on reader service card

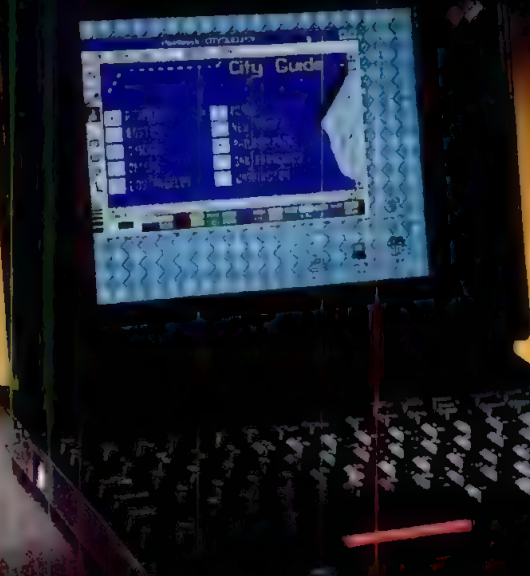
AST Research Inc.

AST Bravo LP 4/33

At \$2,420, the AST Bravo LP 4/33 is priced more like a 486DX2/66 system. Yet it would be an ideal choice for an office that's open 24 hours a day if expan-

AMS InfoGold 486-66ES	
SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	FAIR
Power consumption	POOR



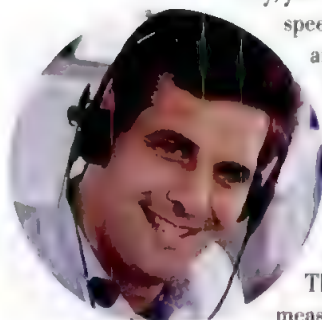



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Expansion Cards and Power Use

While Energy Star compliance is being touted by most PC vendors, the EPA-inspired regulation addresses only the amount of power a system uses in power-conserving idle mode. The Energy Star guideline, however, does not set a limit on how many watts should be consumed at full power. We found that the units in this roundup, in idle mode, can easily stay below the 60-watt limit for both

removed various components. In every instance, we loaded the appropriate drivers and measured the average power draw over a period 10 minutes. The power consumption of this Deskpro PC without any add-on cards and without a monitor was 40 watts.

The most common cards used today are probably network cards. In our testing, network cards consumed

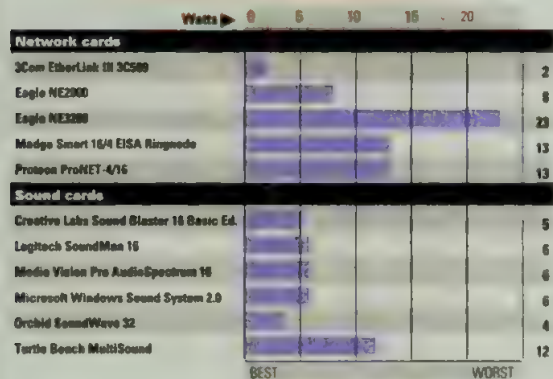
from a low of 2 watts (the 3Com EtherLink III 3C500 card) to a high of 23 watts (the NE 3200 card). A caveat concerning network cards: Because green PCs, in idle mode, cut power to the network card—thus risking that the system's connection to the server will be lost—you must choose the combination of PC and network card carefully. The only green network card we have

seen so far that contains special circuitry to hold onto the network comes from AST.

Sound cards use less electricity than network cards on the whole. Generally, sound cards consume about 5 watts. The Turtle Beach MultiSound card, acknowledged as the PC world's equivalent of high fidelity, uses the most electricity—11.8 watts.

—Amarendra Singh and Dan Begun

Expansion Cards and Power Consumption

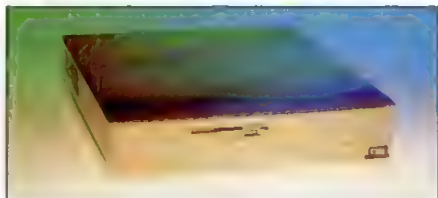


the system unit and monitor. Additional expansion cards, however, can add a burden when operating in full-power mode.

We decided to look at the power consumption of some popular add-in network and sound cards. To do this, we mirrored our general power-consumption test methodology. We used a Compaq Deskpro 486/33M with 8MB of RAM as a standard test-bed; we then added and

sion space is not important.

At full power, the system unit operates at 26.2 watts; in standby mode, the system unit powers down to 20.3 watts. The monitor powers down to 22.7 watts from a high of 59.2. Power management settings are easily accessed through the AMI BIOS setup utility. There are options to shut down the hard disk after up to 16 minutes of idleness,



the rest of the system after up to 240 minutes. The option to shut down the Western Digital 340MB hard disk separately is a welcome touch, considering that it is the unit's main power drain.

On our benchmark tests, the AST

Bravo LP posted scores that were mostly average for its processor class. The unit's integrated ATI Mach32 video chip set was no

match for some of the other local-bus-based video subsystems in this roundup. The unit's processor and Disk WinMark scores, however, were among the best in its class.

The AST Bravo LP will give you the energy-saving capabilities you want, but other systems offer the same capabilities and more power for less money.—BF

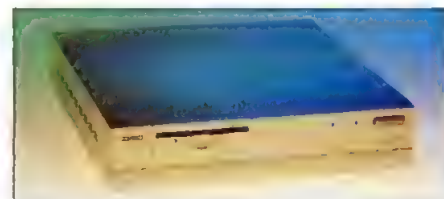
► **AST Bravo LP 4/33.** List price (tested configuration): \$2,420. Processor/memory: Intel 486DX/33, 8MB RAM. Data storage: Western Digital Caviar 2340 340MB IDE hard disk with 128K cache, integrated disk controller. Display: Integrated local-bus video controller with 1MB DRAM; ASTVision 5L 15-inch monitor with a 72-Hz refresh rate at 1,024-by-768. Software: DOS 6.0, Microsoft Windows 3.1. AST Research Inc., 800-876-4278, 714-727-4141.

Circle 451 on reader service card

AT&T Global Information Solutions

AT&T 3227

The \$2,512 AT&T 3227 was built to fill a specific niche, but this unit would work in any space-constrained location. Originally designed for an airline looking for a small-footprint system, the AT&T 3227 is



well-suited for a network environment where expansion is not a major concern.

Power management is operated through preinstalled software and is manipulated through Windows or by editing the CONFIG.SYS file. Although the method of power management operation is well docu-

mented, you can't control the features as easily as you could if they were operated through a BIOS setup utility—as they are in many of the other units in this roundup. But the power management scheme works well: In standby mode, the CPU powered down from 29.1 watts (already compliant with the Energy Star requirement) to 20.3 watts; the monitor's power consumption fell from 67.1 watts to 0.4 watts.

On our benchmark tests, the AT&T 3227 fell in line with all the other 33-MHz systems in this roundup, and it made

▶ AT&T 3227	
SUITABILITY TO TASK	
DOS applications	FAIR
Windows applications	FAIR
Expandability	POOR
Power consumption	GOOD

strong showings on our DOS video and Winstone tests. The system's Quantum 240MB hard disk helped the system produce average scores on disk tests under both DOS and

Windows. One good feature of this unit was the inclusion of a ZIF socket on the motherboard, which makes CPU upgrades easy.—BF

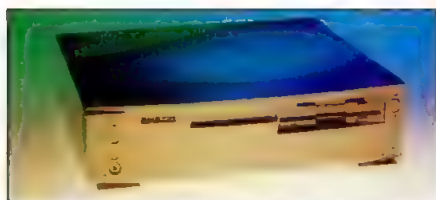
▶ **AT&T 3227.** List price (tested configuration): \$2,512 (estimated street price). Processor/memory: 8MB SIMMs, no external cache. Data storage: Quantum 240AT 240MB IDE hard disk with 32K cache, integrated disk controller. Display: Integrated local-bus video controller with 1MB VRAM; NCR 3298-0241 14-inch monitor with a 72-Hz refresh rate at 800-by-600. Software: DOS 6.0, Microsoft Windows 3.1. AT&T Global Information Solutions, 800-225-5627, 513-445-5000.

Circle 452 on reader service card

Austin Computer Systems

Austin Genesis

The \$2,379 Austin Genesis is a well-designed system that offers flexible energy savings and more space for expansion than most PCs found in slimline cases.



The first thing you might notice when you pop off the cover is how well designed the motherboard is. User-adjustable power management features are config-

▶ Austin Genesis	
SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	FAIR
Power consumption	GOOD
VENDOR SERVICE & RELIABILITY	
Reliability	ABOVE AVERAGE
Repair service	AVERAGE
Technical support	AVERAGE

ured through the BIOS setup or through preinstalled software. The hard disk can be powered down after from 2 to 15 minutes of idleness, the CPU and monitor after from 10 to 120 minutes of idleness. During standby mode, the system unit's power consumption dropped from 30.7 watts

to 21.5 watts, and the monitor fell from 57.6 watts to 0 watts.

For many users, this machine's benchmark test performance may leave a bit to be desired. This PC's motherboard-integrated local-bus video subsystem did not help its graphics performance. But the system did turn in scores on a par with those of similarly configured systems.

The Austin Genesis combines average DX2/66 performance with a quality design and good power management features.—BF

▶ **Austin Genesis.** List price (tested configuration): \$2,379. Processor/memory: Intel 486DX2/66, 16MB RAM, 128K external cache. Data storage: Western Digital Caviar 2340 340MB IDE hard disk with 64K cache, integrated disk controller. Display: Integrated VL-Bus video controller with 1MB DRAM; Austin MN2402 15-inch monitor with a 70-Hz refresh rate at 1,024-by-768. Software: DOS 6.2, Microsoft Windows 3.1. Austin Computer Systems, 800-752-1577, 512-339-3500.

Circle 453 on reader service card

Compaq Computer Corp.

Compaq Deskpro XE 433s M270/w

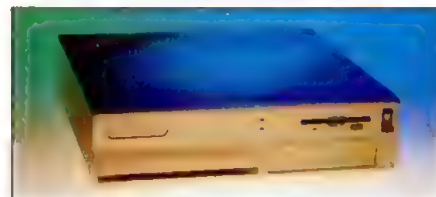
The strong Windows-based graphics performance of the \$2,269 Compaq Deskpro

XE 433s M270/w makes it a solid Windows PC. Compaq's Business Audio sound system and QVision local-bus video subsystem are integrated onto the 486SX/33-based motherboard, leaving three ISA slots open.

In standby mode, the system unit's power consumption fell from 30.9 watts to 23.2; the monitor's power usage fell from 76 to 6 watts. Power management options are manipulated via the Compaq configuration utility and include time-out settings for the system and the monitor, and a separate time-out setting for the hard disk.

This system showed itself to be a good unit under Windows and an average DOS performer in its CPU class. Processor and DOS video scores were average for its class. The fine performance of the 223MB Quantum ProDrive allowed the Deskpro XE to take first place among the 33-MHz units on our DOS disk tests. The unit's excellent Graphics WinMark score was closer to scores posted by the DX2/66-based machines.—BF

▶ **Compaq Deskpro XE 433s M270/w.** List price (estimated): \$2,269. Processor/memory: Intel 486SX/33, 8MB RAM. Data storage: Quantum ProDrive LPS 223MB IDE hard disk, integrated disk



controller. Display: Compaq QVision local-bus integrated video controller with 1MB VRAM; Compaq SVGA Color Monitor Model 471 14-inch monitor with a 60-Hz refresh rate at 800-by-600. Software: DOS 6.0, Microsoft Windows 3.1, TabWorks 1.0, Microsoft Windows Sound System 2.0. Compaq Computer Corp., 800-345-1518, 713-378-8820; fax, 713-378-1442.

Circle 454 on reader service card

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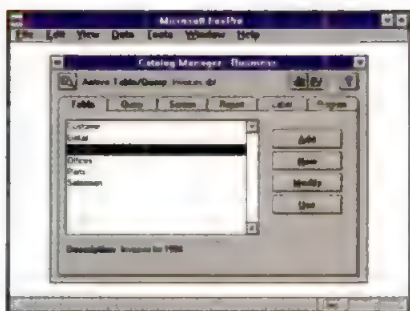
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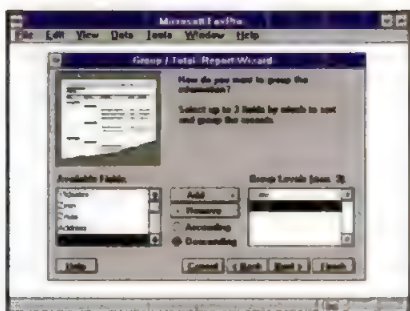
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COVER STORY
Energy Star PCs

Diamond Technologies Inc.

DT 486DX40 E-Star

With the DT 486DX40 E-Star System, Diamond Technologies started with a Cyrix CX486DX40 chip, added some quality components and Energy Star compliance, put it all in a mini-tower case for



\$1,840, and came up with a low-priced winner.

This unit's price and performance alone make it stand out from the pack. On our benchmark tests, the DT E-Star, equipped with a 40-MHz Cyrix processor, distinguished itself in each category. The DT E-Star posted a DOS disk score that was better than those turned in by some of the DX2/66-based units in this roundup; this system also outperformed the Intel-based

33-MHz systems except on our DOS-based video tests, where the DT E-Star—with its Orchid Celsius VLB card—performed poorly.

The system's monitor had no prob-

*The Diamond Technologies
DT 486DX40 E-Star
system posted scores that were
better than those turned in
by some of the DX2/66
units in this roundup.*

lem achieving Energy Star status; its power usage dropped from a relatively high 75.7 watts at full power to 0 watts in standby mode. But the system unit just crept in under the wire: Its power consumption fell from 35.3 watts at full power to 29.4 watts in standby mode. The power management scheme is oper-

ated through the CMOS setup. It's easy to use and has timing options for the monitor, motherboard, and hard disk. Diamond Technologies supplies an adapter so that the monitor can be plugged into the power supply to take advantage of the system's power conservation.

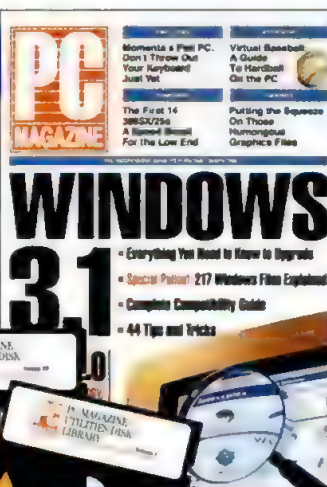
The DT 486DX40 E-Star proves that you can combine performance and power conservation in one affordable package.—BF

► **DT 486DX40 E-Star.** List price (tested configuration): \$1,840. Processor/memory: Cyrix Cx486DX40, 8MB RAM, 256K external cache. Data storage: Conner CP-30344 342MB IDE hard disk with 64K cache, Promise DC4030VL-2 VL-Bus-card disk controller with 512K cache. Display: Orchid Celsius VLB VL-

DT 486DX40 E-Star	
SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	GOOD
Power efficiency	FAIR

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Bus-card video controller with 1MB VRAM; CTX CMS-1461 LX MultiScan 14-inch monitor with a 70-Hz refresh rate at 1,024-by-768. Software: DOS 6.0, Microsoft Windows 3.1. Diamond Technologies Inc., 800-989-7253, 714-533-9910; fax, 714-533-7805.

Circle 455 on reader service card

Digital Equipment Corp.

DECpc LPv+

With performance numbers that rival some of the DX2/66-based units in this review, the DX2/50-based DECpc LPv+ offers enough power to justify its relatively high \$2,568 price tag. But that price includes a lot of extra 16MB RAM, a 256K external cache, and a 345MB Maxtor hard disk.

Even at full power, the DECpc's system unit draws 35.6 watts—not that much above the Energy Star 30-watt limit. In standby mode, it uses 24.2 watts while power consumption by the monitor plunges from 69.4 watts to 0.7. You can set power management features either through the CMOS setup menu in the

Phoenix BIOS or through a Windows utility. You can set the monitor time-outs to intervals of 1 to 30 minutes before the monitor goes into suspend mode and/or shuts off. The only limiting feature of the power management scheme is that the hard disk suspend mode is not user-adjustable: It is set at 21 minutes by the factory but can be disabled.

On our benchmark tests, the DECpc's scores were close to those of the DX2/66-based systems. The unit ran with the DX2/66 pack on both our DOS disk and Disk WinMark tests; it posted strong Graphics WinMark and Winstone numbers as well.

With the DECpc LPv+, you get power and performance at a price that

shouldn't scare you.—BF

► **DECpc LPv+**. List price (tested configuration): \$2,568. Processor/memory: Intel 486DX2/50, 16MB RAM, 256K external cache. Data storage: Maxtor



7345AT 345MB IDE hard disk with 64K cache, integrated disk controller. Display: Integrated video controller with 1MB DRAM; LiteOn PCXBV-PE 14-inch monitor with a 70-Hz refresh rate at 1,024-by-768. Software: DOS 6.0, Microsoft Windows 3.1. Digital Equipment Corp., 800-722-9332; fax, 800-524-5624.

Circle 456 on reader service card

Dyna Micro Inc.

Dyna486 VL Bus Green PC

Although it scores points for performance, the \$1,950 Dyna486 VL Bus Green PC from Dyna Micro lags in ease of use for power conservation.

To adjust the power-saving features, you must edit a preinstalled file with a text editor. This part is relatively straight-

forward, but the power management settings themselves are a cryptic group of ones and zeros that set the same time interval for both the monitor and the hard disk—by now a relatively archaic scheme. Even under full power, however, the system unit meets Energy Star requirements, drawing only 29.5 watts. In standby mode, it draws 23.8 watts; monitor power usage falls from 50.9 watts to 0.4.



The Dyna486's performance on our benchmark tests, however, was anything but archaic, posting numbers that were state-of-the-art DX/33. Its scores on the DOSmark and DOS video tests were first among all 33-MHz systems. Among 33-MHz PCs, the processor score was second only to PC&C's DX/33 system, and the Graphics WinMark score was third behind Compaq's SX/33 and Unisys's DX/33.

The Dyna486 VL Bus Green PC is up to speed in terms of performance, but it has to play catch-up in the power conservation arena.—BF

► **Dyna486 VL Bus Green PC**. List price (tested configuration): \$1,950. Processor/memory: Intel 486DX/33, 8MB RAM, 256K external cache. Data storage: Quantum ProDrive ELS 170MB IDE hard disk with 32K cache, Promise and Winbond PDC20230/W83757AF VL-Bus-card disk controller. Display: Genoa Systems 8500VL VL-Bus-card video controller with 1MB dynamic RAM; Addonics 142 14-inch monitor with a 76-Hz refresh rate at 1,024-by-768. Software: DOS 6.2, Microsoft Windows 3.1. Dyna Micro Inc., 800-362-3962, 408-943-0100; fax, 408-943-0714.

Circle 457 on reader service card

EPS Technologies Inc.

EPS 66DX2 VLG

A good combination of a solid design and middle-of-the-road performance makes the

► **EPS 66DX2 VLG**. \$2,095 EPS 66DX-2 VLG a practical system for users who want a machine they don't have to baby.

The EPS VLG offers two power-saving systems, one is managed through the AMI

BIOS, the other through a Windows utility. Either can be used to the same effect. The EPS VLG easily reaches Energy Star levels of power conservation: Its system unit powers down from a relatively low 30.9 watts to 22.8 watts, while power usage in the monitor drops from 64.0 watts to 6.8 watts. Settings on both power management schemes include separate time-out options for the hard disk and

► DECpc LPv+

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	FAIR
Power efficiency	GOOD
VENDOR SERVICE & RELIABILITY	
Reliability	AVERAGE
Repair service	AVERAGE
Technical support	ABOVE AVERAGE

► Dyna486 VL Bus Green PC

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	FAIR
Power efficiency	GOOD

► EPS 66DX2 VLG

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	GOOD
Power efficiency	FAIR

Faultless Beauty

Multiple Drives and Power Supplies End Data Loss and Downtime.

Your network is your lifeline. And when a hard drive or power supply fails, costs can be staggering (between \$5K and \$100K per hour, according to current estimates) and the consequences ugly. Which is why our fault-tolerant DriveArray™ is an invention of such beauty.

Its RAID (Redundant Array of Independent Disks) technology spreads data across 5 removable drives, and keeps 1 in reserve. A failed drive can be hot-swapped for another while your network purrs along, uninterrupted, and lost data is automatically recreated in the background!

Similarly, two 300-Watt power supplies also protect against interruptions.

If one supply falters the

other takes over. Automatically. And the faulty unit can be hot-swapped while network operations continue.

The DriveArray is plug-compatible with any Standard SCSI controller, and requires no additional controller cards or software drivers. It works with virtually any platform or operating system, including Macintosh, SUN and UNIX, and can be daisy-chained and configured for RAID 0, 1, or Enhanced 5 protection levels.

And all this fault-tolerant technology is packed into a 15" cube that fits on or under any desk. Which truly makes the DriveArray a faultless beauty!

DriveArray

- RAID Levels 0, 1, Enhanced 5
- Drives: 5 x 3.5" (Sixth Bay for Extra Drive or Tape Backup)
- Storage Capacity: 1GB - 8GB; Can Be Daisy-Chained to Expand Storage Capacity



- Auto Re-build of Failed Drive
- Hot Swap Drives
- 6 SCSI Channels; Fast SCSI
- 2 Power Supplies; 2 Fans
- Alarms: Power Supply, Drive Failure
- LED Indicators: P/S Failure, Drive Power, Activity
- SCSI ID Set on Chassis Switch
- FCC Class A
- Dimensions: 15" Cube
- Supports Novell, OS/2, UNIX, Windows NT, Macintosh, and Other Operating Systems
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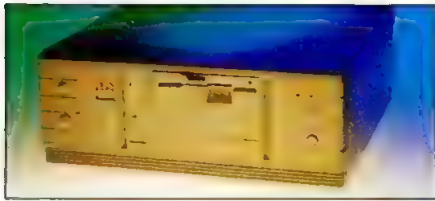


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monitor. An option in the AMI BIOS setup lets you set power-down intervals for the entire motherboard. All major components of this system are certified "green," including power supply, hard disk, and networking card (\$100 option).

Except for some high and low spots, the



system's benchmark test scores were about average for its processor class. A Cirrus Logic-based VL-Bus card did not help the system on either the DOS video or the Graphics WinMark tests. However, a better-than-average score on our Winstone test and a strong showing on the DOS disk tests, achieved with the help of a VL-Bus disk controller, offer insight into the workhorse mentality of this system.—BF

► **EPS 66DX2 VLG.** List price (tested configuration): \$2,095. Processor/memory: Intel 486DX2/66, 16MB RAM, 256K external cache. Data storage: Maxtor 7345AT 345MB IDE hard disk with 64K cache, Kowell KW-559A VL-Bus-card disk controller. Display: EPS GP3000 VL-Bus-card video controller with 1MB DRAM; EPS 1451GM 14-inch monitor with a 60-Hz refresh rate at 1,024-by-768. Software: DOS 6.2, Microsoft Windows for Workgroups 3.11. EPS Technologies Inc., 800-447-0921, 605-966-5586; fax, 605-966-5482.

Circle 458 on reader service card

FutureTech Systems Inc.

FutureTech System 433Vp

Apart from its low \$1,899 price, the 486-DX/33-based FutureTech System 433Vp is an unremarkable PC that had trouble keeping up with the faster systems.

Its design offers good room for expansion. The two VL-Bus slots are filled with a ProSTAR VL video adapter

FutureTech System 433Vp

SUITABILITY TO TASK

DOS applications	FAIR
Windows applications	FAIR
Expandability	GOOD
Power efficiency	GOOD

List price (tested configuration) We report the prices for the systems configured the way we tested them. Some vendors provide an estimated selling price to reflect more accurately what customers should expect to pay for the system.

Hard disk capacity and interface describes the hard disk included in the tested system. All tested systems used IDE as the interface between the hard disk and controller.

Dealers/Direct-distribution channel Some vendors sell only through authorized dealers or company-owned stores. Others sell their PCs directly to users via mail order or combine both methods.

Case style greatly affects a system's expansion potential. Keep in mind that a smaller, well-designed system may rival a larger but poorly arranged one.

Power supply (and number of connectors) We list the wattage of each power supply and the number of connectors for each. The number of connectors determines how many devices the PC can power.

DOS and Microsoft Windows included We asked all vendors to preinstall DOS and Microsoft Windows on their systems before shipping them to us. By the time you read this, most vendors will be shipping DOS 6.2, and many will be including Microsoft Windows for Workgroups 3.11 as the standard system software.

Warranty All vendors in this roundup include at least a one-year parts-and-labor warranty with their systems.

The on-site service charge varies from system to system. If a vendor offers on-site service as an option, we report the cost of that option for one year.

Bus architecture (primary, secondary) refers to the buses that connect the I/O slots to the CPU.

Processor upgrade path Processors can be seated in several different types of sockets, which determine a computer's upgradability. These sockets can be *standard*, *LIF* (low insertion force), or *ZIF* (zero insertion force).

We indicate the **BIOS version (or date)** for each system. The BIOS, which performs a computer's initial boot and test routines, may affect a unit's performance on our benchmark tests.

Flash memory stores the BIOS code, replacing conventional ROM storage for this purpose. Unlike ROM, flash memory can handle both reads and writes, making the BIOS upgradable.

External RAM cache We list the range of external RAM cache a computer can support. For systems that come with a set amount of RAM cache that is not upgradable, we report that amount of external RAM cache.

Cache architecture In a *direct-mapped* cache, each address in main memory is assigned to one location in the cache. Each location in the cache, however, can accept data from many main memory addresses—though not from more than one at once. This one-to-many relationship between main memory and cache often results in bottlenecks. *Two-way set-associative* caches relieve this problem somewhat by allowing each address in main memory to occupy one of two locations in the cache; the penalty is that the cache must be searched to find in which of the two locations data is located. *Four-way set-associative* cache is similar, with each address in main memory corresponding to four locations in the cache.

Cache write design *Write-through* caches write updated data to both cache and main memory. Although write-through cache is relatively easy to implement, it can introduce delays when the processor must wait to complete writes to the slower main memory. For *write-back* cache, data that has been changed is written back to the cache; main memory is updated only when the cached data is replaced, thus minimizing delays.

The **disk controller interface** refers to the type of bus used to connect the CPU to the disk controller circuitry, which is located either on a card or integrated onto the motherboard.

The **display interface type** refers to the bus used to connect the display logic to the CPU. This circuitry is either located on a card or integrated onto the motherboard.

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Portable Productivity For Those Who Work Away From Their Desks More Than 20% of the Time.

Specifically designed to help mobile executives remain productive executives, the new 450 Colorpro's sleek shape and matte-gray shell only hint at the sophisticated technology inside. An effortless touch reveals a brilliant 9.5" active matrix color screen and 84-key keyboard — a 19mm trackball centered just below the space bar. Flip the switch and you'll discover performance and features

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450 Colorpro

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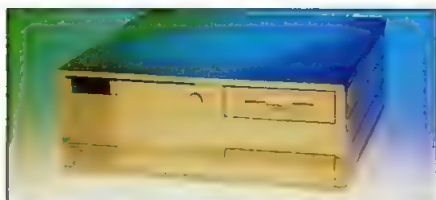
► **SUMMARY OF FEATURES**

Energy Star PCs

In alphabetical order by company ■ = YES □ = NO	AcerPower Series 8000	ACMA 486 Energy Pro	ALR Flyer VL 4/50d	Amax 486 Power Saver	American Computer Research Solar Star 486SL/75	AMS InfoGold 486-66ES	AST Bravo LP 4/33
List price (tested configuration)	\$2,395	\$1,998	\$2,400 (estimated)	\$2,495	\$2,795	\$2,099	\$2,420
Processor type	Intel 486DX2/66	Intel 486DX2/66	Intel 486DX2/50	Intel 486DX2/66	IBM 8L 25/75	Intel 486DX2/66	Intel 486DX/33
Hard disk capacity and interface	345MB IDE	212MB IDE	340MB IDE	342MB IDE	341MB IDE	340MB IDE	340MB IDE
Dealers/Direct-distribution channel	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ □
Case style	Desktop	Desktop	Slimline	Tower	Desktop	Mini-tower	Slimline
Power supply (and number of connectors)	200W (4)	200W (4)	200W (4)	230W (5)	205W (5)	145W (5)	80W (3)
DOS and Microsoft Windows included	■	■	■	■	■	■	■
Warranty	1 year	1 year	5 years parts, 15 months labor	1 year	1 year parts, 5 years labor	1 year	3 years
On-site service charge	Included (1 year)	Included (1 year)	Included (1 year)	\$45 (1 year)	\$135 (1 year)	N/A	Included (1 year)
Processor and Memory							
Bus architecture (primary, secondary)	ISA, VL-Bus	ISA, VL-Bus	ISA, VL-Bus	ISA, VL-Bus	ISA, VL-Bus	ISA, VL-Bus	ISA, proprietary local-bus
Motherboard manufacturer	Acer	FTC	ALR	Impression Intelligent Green	IBM (Alaris)	AIR	AST
Chip set manufacturer	SIS	SIS	OPTi	USA	OPTi	UMC	VLSI
Processor upgrade path	None	Standard	Standard	ZIF	ZIF	ZIF	None
BIOS version (or date)	Acer (10/28/93)	AMI (8/8/93)	Phoenix/ALR (4/19/90)	AMI (8/8/93)	Mr. Bios (9/21/93)	AMI (8/6/92)	IBM (4/30/93)
Plasmemory/16550 UART support	□ □	□ □	■ □	■ □	□ ■	□ □	■ □
Installable system RAM	4MB-64MB	1MB-32MB	4MB-36MB	1MB-32MB	4MB-64MB	4MB-32MB	8MB-64MB
External RAM cache	0-256K	64K-256K	0-256K	64K-256K	256K-512K	256K	0-256K
Cache architecture	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped	Two-way set- associative	N/A
Cache write design	Write-back	Write-back	Write-back	Write-back	Write-back	Write-back	N/A
Components							
Available hard disk sizes	240MB-520MB	80MB-1.4GB	210MB-540MB	170MB-1.2GB	280MB-540MB	245MB-1GB	120MB-520MB
Disk controller interface, location	Proprietary, motherboard	VL-Bus, card	VL-Bus, motherboard	VL-Bus, card	VL-Bus, card	VL-Bus, card	Proprietary, motherboard
Accessible drive bays (5.25", 3.5")	3, 1	3, 1	1, 1	5, 0	3, 1	2, 2	1, 2
Internal drive bays (5.25", 3.5")	0, 2	0, 0	0, 2	1, 2	0, 1	0, 1	0, 1
Floppy disk drives	1.44MB	1.2MB, 1.44MB	1.44MB	1.2MB, 1.44MB	1.44MB	1.2MB, 1.44MB	1.44MB
CD-ROM drive	None	None	None	None	None	Sony CDU-31A-02	None
ISA, EISA, MCA slots	6, 0, 0	5, 0, 0	2, 0, 0	6, 0, 0	4, 0, 0	5, 0, 0	2, 0, 0
VL-Bus, PCI, proprietary local-bus slots	2, 0, 0	3, 0, 0	1, 0, 0	2, 0, 0	2, 0, 0	3, 0, 0	0, 0, 1
Parallel, serial, mouse ports	1, 2, 1	2, 2, 0	1, 2, 1	1, 2, 0	1, 2, 0	1, 2, 0	1, 2, 1
Display circuitry interface, location	VL-Bus, card	VL-Bus, card	VL-Bus, motherboard	VL-Bus, card	VL-Bus, card	VL-Bus, card	Proprietary local- bus, motherboard
Video chip set manufacturer	Cirrus	Cirrus	Western Digital	Cirrus	Cirrus	Cirrus	ATI
Video RAM	2MB	1MB	1MB	1MB	1MB	1MB	1MB

N/A—Not applicable: The product does not have this feature. ALR—Advanced Integration Research Inc., ALR—Advanced Logic Research Inc., AM—American Megatrends Inc., ATI—ATI Technologies Inc., BCM—BCM Advanced Research Inc., ECS—Elite Group Computer Systems Inc., IIT—Integrated Information Technology, SIS—Silicon Integrated Systems Corp., UMC—United Microelectronics Corp., USA—USA Integration, USI—United Solutions Inc., VLSI—VLSI Technology Inc.

and a multifunction disk and I/O controller. However, its scores were competitive only with those of the other DX/33s reviewed. A



ProSTAR VL video adapter did not help the FutureTech 433Vp on either the DOS video or Graphics WinMark test. The 341MB hard disk and its local-bus con-

troller combined to produce weak scores under both DOS and Windows testing.

Energy-saving functions can be set through the CMOS setup program. A push of the reset switch puts the system into standby; you can touch any key to bring it back. In standby, the system unit's consumption dropped from 30.1 watts to 22.8 watts, and the monitor shut itself off.

Except for its low price and expansion space, the FutureTech System 433Vp did not set itself apart from this group.

—Robert Anthony

► **FutureTech System 433Vp.** List price

(tested configuration): \$1,899. Processor/memory: Intel 486DX/33, 8MB RAM, 128K external cache. Data storage: Western Digital Caviar WDAC2340 341MB IDE/LB hard disk with 64K cache, Promise Technology DC2000 VL-Bus-card disk controller. Display: Actix ProSTAR VL VL-Bus-card video controller with 1MB video RAM; ViewSonic 1564-M 15-inch monitor with a 60-Hz refresh rate at 1,280-by-1,024. Software: DOS 6.0, Microsoft Windows 3.1. FutureTech Systems Inc., 800-275-4414, 201-488-4414; fax, 201-488-4405.

Circle 459 on reader service card

CONTINUES

AT&T 3227	Austin Genesis	Compaq Deskpro XE 433a M270/w	Diamond DT 486DX40 E-Star	Digital DECpc LP++	Dyna486 VL Bus Green PC
\$2,512	\$2,379	\$2,269 (estimated)	\$1,840	\$2,568	\$1,950
Intel 486DX/33	Intel 486DX2/66	Intel 486SX/33	Cyrix Cx486DX40	Intel 486DX2/50	Intel 486DX/33
240MB IDE	340MB IDE	223MB IDE	342MB IDE	345MB IDE	170MB IDE
■ ■	■ ■	■ ■	□ ■	■ ■	■ □
Small-footprint 46W (1)	Slimline 150W (4)	Slimline 145W (4)	Mini-tower 220W (3)	Slimline 145W (5)	Desktop 200W (6)
■	■	■	■	■	■
3 years	2 years	3 years	15 months parts, 2 years labor	3 years	1 year
Included (3 years)	Included (1 year)	Included (1 year)	Included (1 year)	Included (1 year)	\$60 (1 year)

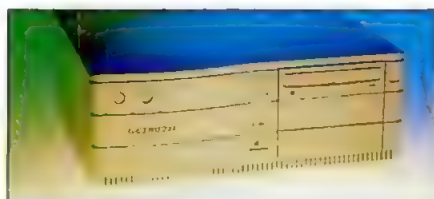
ISA, VL-Bus	EISA, VL-Bus	ISA, proprietary local-bus	ISA, VL-Bus	ISA, proprietary local-bus	ISA, VL-Bus
AT&T Research	BCM Advanced	Compaq	USA	Digital	Shuttle Computer International
UMC	SIS	Compaq	USA	SIS	HINT
ZIF	ZIF	ZIF	ZIF	Standard	Standard
IBM (9/8/93)	AMI (11/11/92)	Compaq (10/11/93)	AMI (8/8/93)	Phoenix (2/28/93)	AMI (8/15/93)
□ ■	□ □	■ ■	□ ■	□ ■	□ □
4MB-32MB	4MB-32MB	4MB-32MB	512K-32MB	4MB-64MB	1MB-32MB
N/A	0-128K	0-256K	64K-256K	0-256K	64K-256K
N/A	Direct-mapped	Two-way set-associative	Direct-mapped	Direct-mapped	Direct-mapped
N/A	Write-back	Write-through	Write-back	Write-back	Posted write-through

120MB-520MB	212MB-424MB	84MB-1.05GB	114MB-1.0GB	170MB-1.0GB	84MB-1.2GB
Proprietary, motherboard	Proprietary, motherboard	Proprietary, motherboard	VL-Bus, card	Proprietary, motherboard	VL-Bus, card
0, 1	2, 1	1, 1	3, 2	0, 2	2, 2
0, 1	0, 1	0, 1	0, 2	1, 2	0, 1
1.44MB	Dual 1.2MB/1.44MB	1.44MB	1.2MB, 1.44MB	1.44MB	1.2MB, 1.44MB
None	None	None	None	None	None
1, 0, 0	5, 0, 0	3, 0, 0	6, 0, 0	3, 0, 0	5, 0, 0
0, 0, 0	0, 0, 0	0, 0, 0	2, 0, 0	0, 0, 1	2, 0, 0
1, 2, 1	1, 2, 1	1, 1, 1	1, 2, 0	1, 2, 1	1, 2, 0
VL-Bus, motherboard	VL-Bus, motherboard	Proprietary local-bus, motherboard	VL-Bus, card	Proprietary local-bus, motherboard	VL-Bus, card
Cirrus	Cirrus	Compaq	ITT	S3	Cirrus
1MB	1MB	1MB	1MB	1MB	1MB

Gateway 2000 Inc.

Gateway 2000 4DX2-50V

A Sony CD-ROM drive and a Diamond Viper VL board go a long way in making new users feel that they're on the cutting edge of PC performance. With the \$2,775 Gateway 2000 4DX2-50V PC, Gateway 2000 brings



high-end performance and CD-ROM to the masses.

Power saving, managed through the Phoenix BIOS, allows separate time-out options for the system unit, hard disk, and monitor. In standby mode the system unit just meets Energy Star requirements, going

from a relative high of 37.5 watts to 29.4 watts, and monitor power consumption drops from 80.3 watts to 11.8 watts.

The Weitek-

based video subsystem contributed to the unit's outstanding scores on our Graphics WinMark tests but yielded poor scores on DOS video. On our other benchmark tests, the Gateway 4DX2-50V placed roughly between the two other DX-2/50-based systems in this review.

Keep the CD-ROM-equipped Gateway 2000 4DX2-50V in mind for high-end graphics and CD-ROM technology.—BF

► **Gateway 2000 4DX2-50V.** List price (tested configuration): \$2,775. Processor/memory: Intel 486DX2/50, 16MB RAM, 128K external cache. Data storage: Western Digital Caviar 2420 404MB IDE hard disk with 128K cache, integrated disk controller, Sony CDU33A CD-ROM drive. Display: Diamond Viper VLB VL-Bus-card video controller with 2MB DRAM; Mag Innovision CS1572FS 15-inch monitor with a 76-Hz refresh rate at 1,280-by-1,024. Software: DOS 6.0, Microsoft Windows 3.1, choice of one Microsoft or Borland mainstream application. Gateway 2000 Inc., 800-846-2000; 605-232-2000.

Circle 460 on reader service card

Hertz Computer Corp.

Hertz 486/D66X2Gi

Inside its slimline case, the \$2,075 Hertz 486/D66X2Gi is a quality 486DX2/66 machine that proved itself a worthy performer.



Integrated on a small motherboard are all basic I/O connections, plus connectors for an IDE hard disk, floppy disk drives, and VL-Bus video. This integra-

GOOD NEWS.



Genesis 486SX-33

\$1,299

Lease \$51/month*

Genesis 486DX-33

\$1,559

Lease \$62/month*



Premier 486DX2-50

\$2,199

Lease \$87/month*

Premier P5-60

\$2,799

Lease \$111/month*

Genesis 486SX-33

- 4 MB RAM, 128 KB L2 Cache
- 212 MB Hard Drive
- 1 MB Local Bus Windows™ Accelerator for 1024x768
- 14" SVGA Monitor
- 5 16-bit ISA Slots

Genesis 486DX-33

- 4 MB RAM, 128 KB L2 Cache
- 212 MB Hard Drive
- 1 MB Local Bus Windows Accelerator for 1024x768
- 14" NI SVGA Monitor
- 5 16-bit ISA Slots

Premier 486DX2-50

- 8 MB RAM, 128 KB L2 Cache
- Sony Double-spin CD-ROM Drive
- 425 MB Hard Drive
- Diamond Stealth 32" VL-Bus Windows Accelerator with 2MB
- 15" NI SVGA Monitor
- 2 VL-Bus and 5 ISA 16-bit Slots
- Softbank "On Hand"™ CD-ROM sampler disk

Premier P5-60

- Intel Pentium™ Processor
- 8 MB RAM, 256 KB L2 Cache
- Sony Double-spin CD-ROM Drive
- 425 MB Hard Drive
- Diamond Stealth 32" PCI-Bus Windows Accelerator with 2MB
- 15" NI SVGA Monitor
- 2 PCI, 1 PCI/ISA, and 4 ISA Slots
- Softbank "On Hand"™ CD-ROM sampler disk
- 17" SVGA monitor upgrade available

BEST NEWS YET!
Sound System Upgrade \$259

Sound Card • Double-spin Sony CD-ROM • Speakers

First, the good news: Austin Direct just lowered the price of our most popular desktop systems, so you can move up in power and performance for much less than you expect.

Now, the great news: wherever your travels take you, you can take the power of the desktop with you. Thanks to our go-anywhere, fully functional notebook computers.

Pick and choose from a complete lineup of Austin computer systems that includes low-priced, high performance 486-based desktops. A blazing Pentium™ processor-powered desktop system, just awarded PC World's "Best Buy" award. An affordable monochrome and dual scan color notebook. And a no-holds-barred color TFT active-matrix notebook, to name but a few.

Whatever your choice, you get an extendable two-year limited warranty on parts and labor for desktop systems, one-year limited warranty for notebooks and



TRAVELS FAST.



Austin 425
\$1,599

Lease \$60/month*

Austin 425C
\$2,199

Lease \$82/month*



**CBG
&H
BEST
BUY**

Austin 466C
\$2,999

Lease \$112/month*

Austin 466T
\$4,499

Lease \$157/month*

Austin 425

- 486SX-25 Processor
- 4 MB RAM
- 127 MB Hard Drive
- 32-bit Local Bus Video and Windows™ Accelerator
- 1 MB Video RAM
- Two PCMCIA Slots
- Front-and-center Trackball
- Monochrome Display

Austin 425C

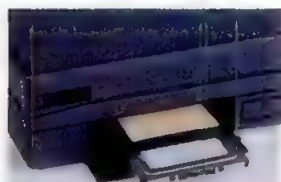
- 486SX-25 Processor
- 4 MB RAM
- 127 MB Hard Drive
- 32-bit Local Bus Video and Windows Accelerator
- 1 MB Video RAM
- Two PCMCIA Slots
- Front-and-center Trackball
- Dual Scan Color Display

Austin 466C

- 486DX2-66 Processor
- 8 MB RAM
- 262 MB Hard Drive
- 32-bit Local Bus Video and Windows Accelerator
- 1 MB Video RAM
- Two PCMCIA Slots
- Front-and-center Trackball
- Dual Scan Color Display

Austin 466T

- 486DX2-66 Processor
- 8 MB RAM
- 524 MB Hard Drive
- 32-bit Local Bus Video and Windows Accelerator
- 1 MB Video RAM
- Two PCMCIA Slots
- Front-and-center Trackball
- TFT Active-Matrix Color Display



PCMCIA Expandability

Two PCMCIA slots take two Type II or one Type III devices for fax modems, LAN adapters, sound cards and more.

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**AUSTIN
D-I-R-E-C-T**

AD CODE PCM 41292

SUMMARY OF FEATURES



In alphabetical order by company ■ = YES □ = NO	EPS 68DX2 VL6	FutureTech System 433Vp	Gateway 2000 40X2-50V	Hertz 486/D66X2Gi	HiQ 40X66 Green PC System	IBM PC PS/1	Insight 486DX2/66 LP
List price (tested configuration)	\$2,095	\$1,899	\$2,775	\$2,075	\$2,199	\$2,525	\$2,099
Processor type	Intel 486DX2/66	Intel 486DX/33	Intel 486DX2/50	Intel 486DX2/66	Intel 486DX2/66	Intel 486DX2/66	Intel 486DX2/66
Hard disk capacity and interface	345MB IDE	341MB IDE	404MB IDE	345MB IDE	527MB IDE	256MB IDE	340MB IDE
Dealers/Direct-distribution channel	■ ■	■ ■	□ ■	■ ■	□ ■	■ ■	□ ■
Case style	Desktop	Desktop	Desktop	Slimline	Mini-tower	Desktop	Slimline
Power supply (and number of connectors)	145W (5)	220W (4)	145W (5)	145W (4)	200W (6)	145W (4)	145W (4)
DOS and Microsoft Windows included	■	■	■	■	■	■	■
Warranty	3 years parts, 1 year labor	15 months	1 year	1 year	1 year parts, 2 years labor	1 year	1 year
On-site service charge	Included (1 year)	\$59 (1 year)	N/A	\$395 (1 year)	N/A	N/A	N/A
Processor and Memory							
Bus architecture (primary, secondary)	ISA, VL-Bus	ISA, VL-Bus	ISA, VL-Bus	ISA, VL-Bus	ISA, VL-Bus	ISA	ISA, proprietary local-bus
Motherboard manufacturer	EPS	USI	Micronics	Intel	Anix	IBM	Intel
Chip set manufacturer	SIS	SIS	Micronics	VLSI	SIS	VLSI	VLSI
Processor upgrade path	ZIF	ZIF	ZIF	ZIF	ZIF	Standard	Standard
BIOS version (or date)	AMI (11/11/92)	AMI (11/11/92)	Phoenix (1/15/88)	Phoenix 1.00 06	AMI (8/8/93)	IBM (9/1/93)	Phoenix (7/23/93)
Flash memory/16550 UART support	□ □	□ □	■ ■	■ □	□ ■	□ □	■ □
Installable system RAM	1MB-32MB	1MB-128MB	8MB-64MB	2MB-32MB	1MB-32MB	1MB-64MB	2MB-32MB
External RAM cache	256K	64K-256K	128K-256K	64K-256K	64K-256K	0-256K	64K-256K
Cache architecture	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped
Cache write design	Write-back	Write-back	Write-through	Write-back	Write-back	Write-back	Write-back
Components							
Available hard disk sizes	245MB-3.1GB	210MB-2.0GB	212MB-1.0GB	345MB-1.0GB	250MB-527MB	256MB-420MB	210MB-340MB
Disk controller interface, location	VL-Bus, card	VL-Bus, card	Proprietary, motherboard	VL-Bus, motherboard	VL-Bus, card	Proprietary, motherboard	Proprietary, motherboard
Accessible drive bays (5.25", 3.5")	2, 2	3, 0	3, 1	2, 1	3, 2	2, 1	2, 1
Internal drive bays (5.25", 3.5")	2, 0	0, 3	0, 1	0, 1	0, 2	0, 1	0, 1
Floppy disk drives	1.2MB, 1.44MB	1.44MB	1.44MB	1.44MB	1.44MB	Dual 1.2MB/1.44MB	1.44MB
CD-ROM drive	None	None	Sony CDU-33A	None	None	None	None
ISA, EISA, MCA slots	7, 0, 0	5, 0, 0	7, 0, 0	5, 0, 0	5, 0, 0	4, 0, 0	3, 0, 0
VL-Bus, PCI, proprietary local-bus slots	2, 0, 0	2, 0, 0	2, 0, 0	0, 0, 1	3, 0, 0	0, 0, 0	0, 0, 0
Parallel, serial, mouse ports	1, 2, 0	1, 2, 1	1, 2, 1	1, 2, 1	1, 3, 0	1, 2, 1	1, 2, 1
Display circuitry interface, location	VL-Bus, card	VL-Bus, card	VL-Bus, card	VL-Bus, motherboard	VL-Bus, card	Proprietary, motherboard	Proprietary local-bus, motherboard
Video chip set manufacturer	Cirrus	Cirrus	Weitek	Cirrus	Cirrus	Cirrus	Cirrus
Video RAM	1MB	1MB	2MB	1MB	1MB	1MB	1MB

N/A—Not applicable. The product does not have this feature. A/R—Advanced Integration Research Inc., A/LR—Advanced Logic Research Inc., A/M—American Megatrends Inc., A/TI—ATI Technologies Inc., B/M—BCM Advanced Research Inc., E/C—Elite Group Computer Systems Inc., I/T—Integrated Information Technology, S/S—Silicon Integrated Systems Corp., U/MC—United Microelectronics Corp., U/S—USA Integration, U/SI—United Solutions Inc., VLS—VLSI Technology Inc.

tion left all five ISA expansion slots open, three of which can hold full-length cards. Power management is easily controlled through Windows software or through a DOS hotkey combination. The system unit powered down from 27.5 watts at full power to 24.3 watts at standby, while its MAG InnoVision monitor went from 76.8 watts at full power to 11.8 watts.

The unit's 345MB Maxtor hard disk

Hertz 486/D66X2Gi	
SUITABILITY TO TASK	
DOS applications	EXCELLENT
Windows applications	GOOD
Expandability	GOOD
Power efficiency	FAIR

and motherboard IDE controller helped it achieve above-average DOS disk and Disk WinMark scores. The Hertz 486/D66X2Gi's local-bus video subsystem, which includes a Cirrus Logic CL-GD5428 chip set and 1MB of video memory, led to adequate DOS video and Graphics WinMark scores.

The Hertz 486/D66X2Gi should appeal to those who want to get started on energy-efficient PCs with a minimum of trouble.—RA

► **Hertz 486/D66X2Gi.** List price (tested configuration): \$2,075. Processor/memory: Intel 486DX2/66, 8MB RAM, 256K external cache. Data storage: Maxtor 7345AT 345MB IDE hard disk with 64K cache, integrated VL-Bus disk controller. Display: Integrated VL-Bus video controller with 1MB DRAM; MAG InnoVision LX1564LG 15-inch monitor with a 60-Hz refresh rate at 1,280-by-1,024. Software: DOS 6.2, Microsoft Windows 3.1. Hertz Computer Corp., 800-232-8737, 212-684-4141; fax, 212-684-3658.

Circle 461 on reader service card

CONTINUES



International Instrumentation Blue Max Mean Green Machine	Matrix Energy Pro 486	Mega ECO486DX2/66D+	Micro Express MicroFLEX-PC/E	Micron 466VL Magoum CD	Mitsuba MIT486 Green PC
\$2,249	\$2,495	\$1,975	\$2,500	\$2,799	\$2,150
Intel 486DX2/66	Intel 486DX2/66	Intel 486DX2/66	Intel 486DX2/66	Intel 486DX2/66	Intel 486DX2/66
251MB IDE	340MB IDE	251MB IDE	340MB IDE	528MB IDE	342MB IDE
■ ■	■ □	■ ■	□ ■	■ ■	■ □
Mini-tower	Desktop	Desktop	Desktop	Desktop	Mini-tower
200W (4)	200W (5)	200W (4)	230W (5)	145W (7)	200W (5)
■	■	■	■	■	■
1 year	2 years	1 year	2 years	1 year	2 years
Included (1 year)	\$25 (1 year)	N/A	\$50 (1 year)	Included (1 year)	\$100 (1 year)
ISA, VL-Bus	ISA, VL-Bus	ISA, VL-Bus	ISA, PCI	ISA, VL-Bus	ISA, VL-Bus
International Instrumentation	BCM	BCM	Micro Express	Micronics	Mitsuba
SIS	SIS	SIS	Intel	Micronics	SIS
ZIF	ZIF	ZIF	ZIF	ZIF	Standard
AMI (8/8/93)	AMI (11/11/92)	AMI (11/11/92)	AMI (10/7/93)	Phoenix 0.10 MJX30G-04	AMI (11/11/92)
□ ■	□ □	□ □	■ ■	■ ■	□ □
4MB-32MB	1MB-32MB	4MB-32MB	4MB-64MB	4MB-64MB	1MB-32MB
128K-256K	128K-256K	128K-256K	64K-256K	256K	256K
Four-way set-associative	Two-way set-associative	Direct-mapped	Direct-mapped	Four-way set-associative	Direct-mapped
Write-back	Write-back	Write-back	Write-through	Write-back	Write-back
170MB-2.4GB	254MB-1.8GB	170MB-2.1GB	300MB-2.4GB	240MB-540MB	200MB-1.8GB
VL-Bus, card	ISA, card	VL-Bus, card	Proprietary	VL-Bus, motherboard	ISA, card
2, 2	3, 2	2, 1	3, 2	3, 0	2, 2
0, 1	0, 0	0, 1	0, 1	0, 3	0, 1
1.44MB	1.2MB, 1.44MB	1.44MB	1.2MB, 1.44MB	1.44MB	Dual 1.2MB/1.44MB
None	None	None	None	Mitsumi FX1001D	None
5, 0, 0	5, 0, 0	5, 0, 0	5, 0, 0	5, 0, 0	5, 0, 0
3, 0, 0	2, 0, 0	2, 0, 0	0, 3, 0	2, 0, 0	2, 0, 0
1, 2, 0	1, 2, 0	1, 2, 1	1, 2, 0	1, 2, 0	1, 3, 0
VL-Bus, card	VL-Bus, card	VL-Bus, card	PCI, card	VL-Bus, card	VL-Bus, card
Cirrus	Cirrus	Weitek	Weitek	Weitek	Cirrus
1MB	1MB	2MB	2MB	2MB	1MB

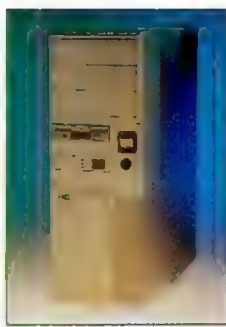
HiQ Systems Inc.

HiQ 4DX66 Green PC System

If you're in the market for a speedy tower computer that's tight on power consumption, you needn't look further than the \$2,199 HiQ 4DX66 Green PC System. Performance, power management, and hot features are all there.

In idle mode, power consumption in the HiQ Green PC's system unit drops from 32.4 watts to 22.3; in the excellent Nanao

F340iW monitor, it drops from 77.4 watts to 0. The HiQ Green PC can cut display power to any monitor plugged into the auxiliary power outlet with a special cable. The AMI BIOS Power Management Setup menu can slow the CPU to 8 MHz, turn off power to the CRT and peripherals, and place the IDE



HiQ 4DX66 Green PC System

SUITABILITY TO TASK	
DOS applications	EXCELLENT
Windows applications	EXCELLENT
Expandability	GOOD
Power efficiency	GOOD

of all tested units on the DOS disk, DOS video, and Disk WinMark tests. The Winstone score was very good, and the Graphics WinMark score was average.

Besides the 15-inch Nanao monitor, the system's better-than-average equipment list includes one of the largest hard disks sent to us in a test machine: a 527MB Conner with a Promise VL-bus hard disk controller.—Bruce Brown

HiQ 4DX66 Green PC System. List

EDITORS' CHOICE price (tested configuration): \$2,199. Processor/memory: Intel 486DX2/66, 8MB RAM, 256K external cache. Data storage: Conner CP30544 527MB IDE hard disk with 256K cache, Promise DC-2000B VL-Bus card disk controller. Display: Genoa 8500VL VL-Bus card video controller with 1MB DRAM; Nanao F340iW 15-inch monitor with a 60-Hz refresh rate at 1,280-by-1,024. Software: DOS 6.2, Microsoft Windows 3.1. HiQ Systems Inc., 800-827-5836, 408-245-5836; fax, 408-245-3108.

Circle 462 on reader service card

IBM Personal Computer Co.

IBM PC PS/1

The focus of the \$2,525 IBM PC PS/1 is not on all-out performance but on power management and ease of use for the first-time buyer.

The PS/1 is designed for the new user, even one intimidated by technology. Power management is controlled

IBM PC PS/1

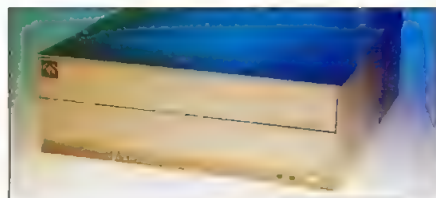
SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	FAIR
Power efficiency	EXCELLENT
VENDOR SERVICE & RELIABILITY	
Reliability	ABOVE AVERAGE
Repair service	ABOVE AVERAGE
Technical support	AVERAGE

► SUMMARY OF FEATURES

In alphabetical order by company ■ = YES □ = NO		National MicroComputers NMC Pro-System 466	NEC Ready 466es	NETis 486 VESA Green PC	PC&C Iguana EG-2009	Poly 486GPC	Tagram V-Line CD/Green	Tangent VLo 466
List price (tested configuration)		\$2,098	\$1,999 (estimated)	\$2,499	\$2,045	\$2,350	\$2,059	\$2,198
Processor type		Intel 486DX2/66	Intel 486DX2/66	Intel 486DX2/66	Intel 486DX/33	Intel 486DX2/66	Intel 486DX2/66	Intel 486DX2/66
Hard disk capacity and interface		340MB IDE	251MB	340MB IDE	203MB IDE	340MB IDE	425MB IDE	260MB IDE
Dealers/Direct-distribution channel		■ ■	□ ■	□ ■	■ ■	■ ■	■ ■	□ ■
Case style		Desktop	Slimline	Desktop	Small-footprint	Desktop	Mini-Tower	Desktop
Power supply (and number of connectors)		200W (5)	145W (4)	200W (7)	60W (3)	150W (4)	200W (6)	200W (5)
DOS and Microsoft Windows included		■	■	■	■	■	■	■
Warranty		1 year parts, 2 years labor	1 year	1 year	1 year	2 years parts, 5 years labor	2 years	1 year
On-site service charge		\$39 (1 year)	Included (1 year)	\$75 (1 year)	\$99 (1 year)	\$75 (1 year)	Included (1 year)	Included (1 year)
Processor and Memory								
Bus architecture (primary, secondary)		ISA, VL-Bus	ISA, proprietary local-bus	ISA, VL-Bus	ISA, proprietary local-bus	ISA, VL-Bus	ISA, VL-Bus	ISA, VL-Bus
Motherboard manufacturer		ECS	NEC Technologies	Free Technology	PC&C Research	Cache Computers	BCM Advanced Research	Cache Computers
Chip set manufacturer		UMC	Chips	SIS	Pico Power	SIS	SIS	SIS
Processor upgrade path		ZIF	ZIF	ZIF	Standard	ZIF	ZIF	ZIF
BIOS version (or date)		AMI (4/4/93)	Phoenix (8/4/93)	AMI (8/8/93)	Phoenix 1.03 Rel. 2.70	AMI (6/6/92)	AMI (11/11/92)	AMI (6/6/92)
Flash memory/16550 UART support		□ □	■ □	□ □	□ ■	□ □	□ □	□ □
Installable system RAM		1MB-64MB	4MB-36MB	1MB-32MB	1MB-32MB	4MB-64MB	1MB-32MB	4MB-128MB
External RAM cache		256K	0-256K	64K-256K	N/A	64K-512K	0-256K	64K-256K
Cache architecture		Direct-mapped	Direct-mapped	Direct-mapped	N/A	Four-way set- associative	Direct-mapped	Direct-mapped
Cache write design		Write-back	Write-through	Write-back	N/A	Write-back	Write-back	Write-back
Components								
Available hard disk sizes		340MB-2.1GB	251MB	124MB-540MB	170MB-1.0GB	170MB-2.5GB	250MB-1.0GB	170MB-540MB
Disk controller interface, location		VL-Bus, card	Proprietary, motherboard	VL-Bus, card	Proprietary, motherboard	Proprietary, motherboard	VL-Bus, card	VL-Bus, card
Accessible drive bays (5.25", 3.5")		3, 0	2, 1	3, 2	0, 1	2, 0	2, 2	3, 0
Internal drive bays (5.25", 3.5")		0, 3	0, 0	0, 1	0, 1	1, 1	0, 0	1, 1
Floppy disk drives		Dual 1.2MB/ 1.44MB	1.44MB	1.2MB, 1.44MB	1.44MB	Dual 1.2MB/ 1.44MB	1.44MB	1.44MB
CD-ROM drive		None	None	None	None	None	Panasonic CR-562B	None
ISA, EISA, MCA slots		5, 0, 0	3, 0, 0	5, 0, 0	3, 0, 0	6, 0, 0	5, 0, 0	6, 0, 0
VL-Bus, PCI, proprietary local-bus slots		3, 0, 0	0, 0, 1	3, 0, 0	0, 0, 1	2, 0, 0	2, 0, 0	2, 0, 0
Parallel, serial, mouse ports		1, 2, 0	1, 1, 1	1, 2, 0	1, 2, 1	1, 2, 0	1, 2, 1	1, 2, 0
Display circuitry interface, location		VL-Bus, card	Proprietary local- bus, motherboard	VL-Bus, card	Proprietary local- bus, motherboard	VL-Bus, card	VL-Bus, card	VL-Bus, card
Video chip set manufacturer		Tseng	Cirrus	Cirrus	Chips & Technologies	S3	Tseng	Tseng
Video RAM		2MB	1MB	2MB	1MB	2MB	2MB	2MB

N/A—Not applicable. The product does not have this feature. AIR—Advanced Integration Research Inc., ALR—Advanced Logic Research Inc., AM—American Megatrends Inc., ATI—ATI Technologies Inc., BGA—Ball Grid Array, BIOS—Basic Input/Output System, C—Cache, CD—Compact Disc, CPU—Central Processing Unit, D—Disk, E—Expansion, F—Floppy, G—Graphics, H—Hard Disk, I—Integrated, L—Local, M—Memory, P—Power, S—Serial, T—Terminal, U—Ultra, V—Video, W—Windows, X—Expansion, Y—Year, Z—Zero.

through a preinstalled Smart Energy System located on the motherboard. Energy Star compliance offers a deep-sleep



standby mode and Rapid Resume, a feature that allows the last Window visible to return when the system quickly wakes up. In standby mode, power consumption in

the PS/1's system unit drops from 38.0 watts to just 0.8; monitor power consumption, from 82.7 watts to 20.3.

This system is not a screamer when compared with the other DX2/66-based systems. It yielded average, even-handed performance across the range of tests, with only three scores—Graphics WinMark, DOS video, and DOS disk—placing just below the average.

IBM designed the PS/1 to be brought home as a learning tool or used in a small-business environment. With Windows and Microsoft Works preinstalled, includ-

ing tutorials, this is a state-of-the-art PC that is ready to roll.—BF

► **IBM PC PS/1.** List price (tested configuration): \$2,525. Processor/memory: *Intel 486DX2/66, 8MB RAM, 128K external cache.* Data storage: *IBM H3256-AS 256MB IDE hard disk with 96K cache, integrated disk controller.* Display: *Integrated video controller with 1MB DRAM; IBM 6324001 14-inch monitor with a 60-Hz refresh rate at 1,280-by-1,024.* Software: *DOS 6.0, Microsoft Windows 3.1, Microsoft Works for Windows 2.0, Smart Energy System Software, Prodigy, PS/1 Tutorial and*

ENDS

Tri-Star ESPC DX-2	Uta UL-486/66-LPC	Unisys PW [®] Advantage Partner ELI 4333	United Solutions USI Green PC	Unitek UT-486DX2/66LBES
\$2,490	\$2,211	\$2,481	\$1,745	\$2,135
Intel 486DX2/66 324MB IDE	Intel 486DX2/66 424MB IDE	Intel 486DX/33 244MB	Intel 486DX2/66 245MB IDE	Intel 486DX2/66 341MB IDE
■ ■	■ ■	■ ■	■ ■	□ ■
Slimline 145W (2)	Desktop 200W (5)	Desktop 200(4)	Desktop 150W (4)	Desktop 230W (5)
■	■	■	■	■
2 years parts, lifetime labor Included (1 year)	1 year parts, 5 years labor N/A	1 year Included (1 year)	1 year N/A	1 year parts, lifetime labor Included (1 year)
ISA, proprietary local-bus	ISA, VL-Bus	ISA	ISA, VL-Bus	ISA, VL-Bus
Intel	Leadertech Systems	First International Computer	USI	Shuttle
VLSI	SIS	V/A	SIS	HiNT
Standard	ZIF	Standard	ZIF	ZIF
Phoenix (3/22/93)	AMI (8/8/93)	Award (9/4/93)	AMI (11/11/92)	AMI (8/15/93)
■ ■	□ □	□ □	□ ■	□ □
4MB-32MB 128K-256K	1MB-64MB 0-256K	2MB-64MB 0-256K	1MB-32MB 0-256K	4MB-128MB 128K-256K
Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped
Write-back	Write-back	Write-back	Write-back	Write-back
255MB-540MB Proprietary, motherboard	200MB-424MB VL-Bus, card	85MB-244MB IDE, motherboard	210MB-350MB VL-Bus, card	250MB-1.0GB VL-Bus, card
2, 1	3, 1	1, 1	3, 0	3, 2
0, 1	0, 0	0, 1	0, 0	0, 0
1 44MB	1.2MB, 1 44MB	1 44MB	Dual 1 2MB/ 1 44MB	Dual 1 2MB/ 1 44MB
None	None	None	None	None
3, 0, 0	5, 0, 0	3, 0, 0	5, 0, 0	5, 0, 0
0, 0, 0	3, 0, 0	0, 0, 0	2, 0, 0	2, 0, 0
1, 2, 1	1, 2, 0	1, 2, 1	1, 2, 1	1, 2, 0
Proprietary local-bus, motherboard	VL-Bus, card	Proprietary, motherboard	VL-Bus, card	VL-Bus, card
Cirrus	Cirrus	S3	Tseng	Cirrus
512K	1MB	1MB	2MB	1MB

Index, PS/1 Fitness, mouse. IBM Personal Computer Co., 800-426-3377, 914-766-1900.
Circle 463 on reader service card

Insight

Insight 486DX2/66 LP

Housed in a low-profile slimline case, the \$2,099 Insight 486DX2/66 LP is a competent performer that offers solid power management.

In standby mode, power consumption in the Insight LP's system unit went from

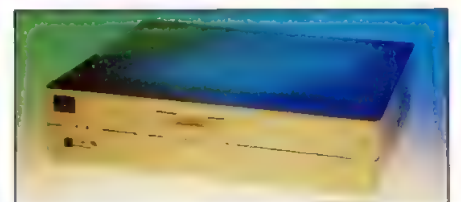
Insight 486DX2/66 LP	
SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	GOOD
Power efficiency	FAIR

spin-down, and system unit time-outs; you can also set a hotkey for immediate shut-

down. In suspend mode, it brings the Insight LP's screen back immediately, but when power comes back on from shutdown mode, resuming operation takes more time and causes a good deal of flicker and bounce on-screen.

Except for a low Graphics WinMark score, the Insight LP turned in average results across the board. Insight uses a pro-

prietary local-bus design in the system LP but chose to run the Western Digital Caviar 340MB hard disk off a standard IDE interface.



Although it is not a powerhouse, the space-saving Insight 468DX2/66 LP is an acceptable buy.—BB

► **Insight 486DX2/66 LP.** List price (test-bed configuration): \$2,099. Processor/memory: 486DX2/66, 8MB RAM, 256K external cache. Data storage: Western Digital Caviar 2340A 340MB IDE hard disk with 32K cache, integrated disk controller. Display: Integrated local-bus video controller with 1MB DRAM; MAG CMDX15 15-inch monitor with a 72-Hz refresh rate at 1,024-by-768. Software: DOS 6.2, Microsoft Windows 3.1. Insight, 800-729-0770, 602-902-1176.

Circle 464 on reader service card

International Instrumentation Inc.

International Instrumentation Inc.

Blue Max Mean Green Machine

The performance of the \$2,249 Blue Max Mean Green Machine is not hindered by the crowded conditions inside its minitower case. Energy Star compliance and above-average performance on all our benchmark tests add up to a machine that is packed with power.

As in the Diamond and NETis PCs, power saving in the Blue Max is managed in the AMI BIOS.



Minimal Desktop PCs

The computer revolution has taken us from room-size number crunchers to multiprocessing desktops, always delivering more power in smaller packages. With recent efforts by IBM



IBM's PS/2 E and APF's 4000 earn high marks for design.

and APF, the dream of a minimal PC that doesn't hog all your desktop space is almost at hand, but it's going to cost you.

To start with, both of the systems we examined rely on 10.4-inch active-matrix color LCD panels instead of bulky CRT monitors. Though they are more energy-efficient and certainly more compact, the LCD panels add several thousand dollars to the prices of these machines: Both of them list for over \$6,000. On the IBM PS/2 E, the panel is separate from the very compact case; on the APF 4000, the panel is integrated onto a thick stand that is your PC. Each takes up a minimal amount of desktop real estate.

Needless to say, expansion is not what these systems were designed for. The IBM PS/2 E, however, does offer four Type II PCMCIA slots to the APF 4000's one. Both units have 3.5-inch floppy disk drives. The APF 4000 offers configurations with up to 32MB of RAM and PCMCIA card-based networking (using an Ethernet 10-BaseT, 10Base2, or Token-Ring interface); the IBM PS/2 E is upgradable to 16MB of RAM.

Neither of these machines is a top performer. On nearly every test, both turned in scores that were well below average when compared with systems with the same or similar processors that were tested in this line-up. The scores for these two units were more in line with those of high-performance notebooks. But although the APF 4000 had no external cache, this system turned in average scores on both our DOS video and processor tests.

These two machines do deliver in terms of energy conservation. Even at full power, both systems use less than the allowable amount of power for Energy Star compliance. The APF 4000 had a total power consumption of 45.1 watts at full power, 44 watts in idle mode. This system's power management scheme is not very sophisticated, consisting only of a display time-out that you can set for 10, 20, or 60 minutes.

The IBM PS/2 E has a more involved power management arrangement. The system unit consumed 13.1 watts at full power, 12.1 watts in idle mode; display consumption was 24.6 watts at full power, 10 watts in idle mode. (The unit's total power consumption at full power was 37.7 watts.)

But the IBM PS/2 E also offers slightly more flexibility: You can set the hard disk to power down after from 10 to 20 minutes of idleness, and there is a two-step fixed display time-out. The first step shuts down the panel's backlight after 30 minutes of disuse; the second phase powers it down completely after 15 subsequent minutes of idleness. Both of these systems recover quickly from idle mode.

—by Anush Yegyzarian

► **IBM PS/2 E.** List price: \$6,170. Configuration: IBM 486SLC2/50 CPU, 8MB RAM, 120MB hard disk. IBM Personal Computer Co., Rte. 100, Somers, NY 10589; 800-426-2968, 914-766-1900.

Circle 501 on reader service card

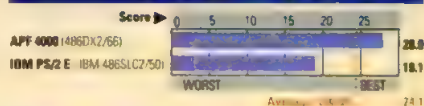
► **APF 4000.** List price: \$7,215. Configuration: 486DX2/66 CPU, 8MB RAM, 170MB hard disk. APF, P.O. Box 25126, Greenville, SC 29616; 803-244-4416.

Circle 502 on reader service card

WINSTONE



PROCESSOR



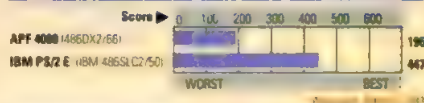
GRAPHICS WINMARK



VIDEO



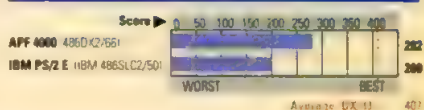
DISK WINMARK



DISK



DOSMARK



Time-out options range from 1 to 255 minutes and are separate for the monitor, motherboard, and hard disk. Standby mode lowers system unit power consumption from 37.2 watts to 29.3; the monitor, which draws 60.7 watts at full power, shuts off completely.

The Blue Max Mean Green Machine finished in the top ten on all our benchmark tests. It posted close second-place scores on

Blue Max Mean Green Machine	
SUITABILITY TO TASK	
DOS applications	EXCELLENT
Windows applications	EXCELLENT
Expandability	GOOD
Power efficiency	FAIR

our processor, DOSmark, and DOS video tests, and its Graphics WinMark score surpassed those of similarly equipped systems that used the Genoa 8500-VL board.

This system offers a little of everything, from upgradability and expandability to power savings and performance.—BF

► **Blue Max Mean Green Machine.** List price (tested configuration): \$2,249. Processor/memory: Intel 486DX2/66, 8MB RAM, 256K external cache. Data storage: Conner CP30254 251MB IDE hard disk with 256K cache, Promise Technology DC4030VL-2 VESA local-bus card disk controller with 2MB cache. Display: Genoa Systems 24 Model 8500VL VL-Bus card video controller with 1MB DRAM; Samsung SyncMaster 15C 15-inch monitor with a 72-Hz refresh rate at 1,024-by-768. Software: DOS 6.2, Microsoft Windows 3.1. International Instrumentation Inc., 800-543-3475, 805-495-7673; fax, 805-379-0701.

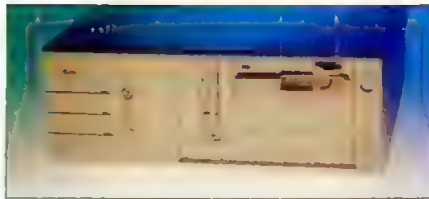
Circle 465 on reader service card

Matrix Digital Products Inc.

Matrix Energy Pro 486

The \$2,495 Matrix Energy Pro 486 offers solid performance and power-saving abilities, but you could find machines that offer more for the money.

The Matrix Energy Pro's test scores were generally average, with one below-average score. Compared with the scores of other machines based on Intel's 486DX2/66 CPU, the Matrix Energy Pro's Winstone and DOSmark scores were both average. The machine's weakness is its



graphics performance under Windows, as evidenced by its below-average score on our Graphics WinMark tests. The Matrix Energy Pro fared better on our DOS video tests, however, where it posted an above-average score.

The power-saving mode reduces the system unit's power usage from 34.6 watts to 26.5 watts, and the monitor's from 56.4 watts to 0.2 watts. Power-down timing is adjustable through the CMOS setup screen;

Matrix Energy Pro 486

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	FAIR
Expandability	FAIR
Power efficiency	FAIR

you can set the hard disk to power down after 5, 10, or 15 minutes of disuse, and the system unit and monitor can be set to power-down after from 1 minute to 2 hours of inactivity. The machine recovers from standby mode almost quickly.

One of the more expensive of the machines tested, the Matrix Energy Pro 486 provides better performance under DOS than it does under Windows.—Elisabeth H. Holzer

► **Matrix Energy Pro 486.** List price (tested configuration): \$2,495. Processor/memory: Intel 486DX2/66, 16MB RAM, 256K external cache. Data storage: Conner CFA340A 340MB IDE hard disk with 64K cache, integrated disk controller. Display: Cirrus Logic 5428 VL-Bus-card video controller with 1-MB DRAM; Mitsubishi F562D 15-inch monitor with a 72-Hz refresh rate at 1,280-by-1,024. Software: DOS 6.2, Microsoft Windows 3.1. Matrix Digital Products Inc., 800-227-5723, 909-392-5635; fax, 909-392-5629.

Circle 466 on reader service card

Mega Computer Corp.

Mega ECO486DX2/66D+

With midrange performance scores and only marginally acceptable power reduction, Mega Computer Corp.'s \$1,975 Mega

ECO486DX2/66D+ is unexceptional.

The Mega ECO uses the AMI BIOS setup to adjust hard disk time-out, system unit slowdown, and monitor time-out, all of which awakened fairly quickly in both DOS and Windows. Monitor power usage

Mega ECO486DX2/66D+	
SUITABILITY TO TASK	
DOS applications	FAIR
Windows applications	GOOD
Expandability	GOOD
Power efficiency	POOR

was 52.7 watts at full power; it shut off at idle, which is fine, but the system-unit power draw decreased only to 31.5 watts at idle from its 39.3-watt level at full power. Its total standby-mode power usage (system unit and monitor combined), however, was no more than 60 watts.

The Mega ECO's benchmark test scores were as disappointingly low as its power use was high. Within its CPU class, the machine posted the lowest DOSmark score; its DOS video score was the worst of all the systems we tested. This unit also performed rela-

tively poorly on all other tests—with the exception of our Graphics WinMark tests, where the Weitek P9000-based Diamond Viper card helped it attain one of the best scores of all tested systems.



While the Mega ECO486DX2/66D+ may be one of the lowest-priced systems in this roundup, it is also one of the poorest performers.—BB

► **Mega ECO486DX2/66D+.** List price (tested configuration): \$1,975. Processor/Memory: Intel 486DX2/66, 8MB RAM, 128K external cache. Data storage: Conner CP30254H 251MB IDE hard disk with 64K cache, Promise DC4030VL-1 VL-Bus-card disk controller with 2MB cache. Display: Diamond Viper VL-Bus-card video controller with 2MB VRAM; MGC-Micro Express 1402N 14-inch monitor with a 60-Hz refresh rate at 1,024-by-768. Software: DOS 6.2, Microsoft Windows 3.1. Mega Computer Corp., 800-338-6628, 619-487-8888; fax, 619-485-1518.

Circle 467 on reader service card

Micro Express

MicroFLEX-PCI/E

The \$2,500 MicroFLEX-PCI/E is an excellent Windows performer that unfortunately takes too long to emerge from its power-saving sleep mode.

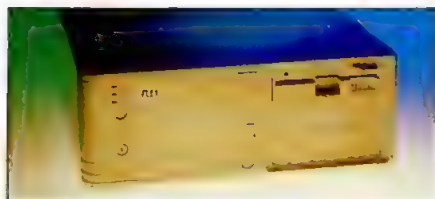
MicroFLEX-PCI/E	
SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	EXCELLENT
Expandability	EXCELLENT
Power efficiency	POOR

The MicroFLEX turned in excellent scores on all benchmark tests except the DOS video tests, where it was outperformed by almost every other system in this roundup. Its weak DOS video score

explains why its DOSmark score was also not among the highest.

If Windows performance is the MicroFLEX's strong suit, power conservation is its weak one. This system's power management is controlled by the Green Card, which demands extra power from the system unit. The system unit's power consumption therefore dipped only slightly in sleep mode, from 40.5 watts to 36.8 watts; since the monitor shut off, the system's total power consumption in idle mode was under 60 watts. The timing of the sleep mode can be configured by the user via software. Unfortunately, the machine took between 5 and 10 seconds to regain full computing power from standby mode.

The MicroFLEX-PCI/E offers solid Windows performance, but the power



savings are offset by delayed awakening from standby mode.—EH

► **MicroFLEX-PCI/E.** List price (tested configuration): \$2,500. Processor/memory: Intel 486DX2/66, 16MB RAM, 256K external cache. Data storage: Western Digital Caviar 2340 340MB IDE hard disk with 128K cache, integrated disk controller. Display: Diamond Viper PCI local-bus-card

video controller with 2MB VRAM; Micro Express FM590 15-inch monitor with a 72-Hz refresh rate at 1,024-by-768. Software: DOS 6.2, Microsoft Windows 3.1. Micro Express, 800-989-9900, 714-852-1400; fax, 714-852-1225.

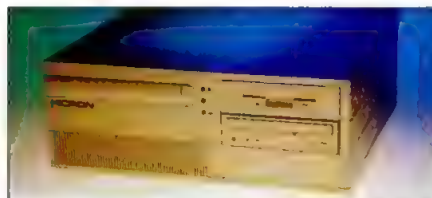
Circle 468 on reader service card

Micron Computer Inc.

Micron 466VL Magnum CD

Once in a while a company really hits all the hot buttons for PC buyers. Micron Computer gets high performance from quality components and thoughtful design, and offers it for \$2,799 in the Micron 466VL Magnum CD.

Power management is manipulated through the system's Phoenix BIOS. In standby mode, the system unit operated



at 26.7 watts, down from 39.1 watts at full power; the monitor's power usage fell from 68.9 watts to 7.5 watts. Power-savings options include separate time-out settings for the system unit, hard disk, and video subsystem.

The Micron Magnum placed first on our processor and DOS disk tests and also on our Disk WinMark, Graphics WinMark, and Winstone tests. Though this unit did well on our Graphics WinMark tests, its DOS video score was disappointing.

With its CD-ROM drive, or DX2/66 CPU, Micronics motherboard, and Diamond Viper card, the Micron 466VL Magnum CD is clearly earmarked for the high-end user.—BF

Micron 466VL Magnum CD	
SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	EXCELLENT
Expandability	EXCELLENT
Power efficiency	GOOD
VENDOR SERVICE & RELIABILITY	
Reliability	ABOVE AVERAGE
Repair service	AVERAGE
Technical support	ABOVE AVERAGE

EDITORS' CHOICE

► Micron 466VL Magnum

CD. List price (tested configuration): \$2,799. Processor/memory: Intel 486DX2/66, 16MB RAM, 256K external cache. Data storage: Conner FilePro Advantage CFA540A 528MB IDE/LB hard disk with 256K cache, integrated disk controller, Mitsumi FX1001D CD-ROM drive. Display: Diamond Viper VL-Bus-card video controller with 2MB VRAM; MAG InnoVision DX15F 15-inch monitor with a 60-Hz refresh rate at 1,280-by-1,024. Software: DOS 6.0, Microsoft Windows 3.1, WordPerfect 5.2. Micron Computer Inc., 800-388-6334, 208-465-3434; fax, 208-465-3424.

Circle 469 on reader service card

Mitsuba Corp.

Mitsuba MIT486 Green PC

Although the \$2,150 Mitsuba MIT486 Green PC is an Energy Star-compliant mini-tower system powered by a DX2/66 processor, its high price and unimpressive performance may disappoint.

The Mitsuba MIT486's power-saving features are controlled through its AMI BIOS, which allows the timing to be set for idle mode and gives the user control over the hard disk and monitor time-outs. CPU speed is reduced to 8 MHz when the system is idle.

This unit was impressive in terms of power consumption. The system unit's maximum power draw of 33.7 watts dropped to 22.9 watts at idle. The Mitsuba MIT486's monitor used 54.4 watts of power when active and turns off when idle.

On our tests, the unit's scores ranged from barely average to below average. While it just managed to keep pace on our DOS-based tests, its performance under Windows fell off slightly, marked by below-average Graphics WinMark and Disk WinMark scores. The machine came with 16MB of RAM and 256K of external cache, which should have given it an advantage in terms of real-world-application performance, but its Winstone score was only average.—Marino Delzotto



Mitsuba MIT486 Green PC

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	FAIR
Expandability	FAIR
Power efficiency	GOOD

► **Mitsuba MIT-486 Green PC.** List price (tested configuration): \$2,150. Processor/memory: Intel 486DX2/66, 16MB RAM, 256K external cache. Data storage: Conner CP-30344 342MB

IDE hard disk with 64K cache, Mitsuba MC18 ISA-card disk controller with 8MB cache. Display: Mitsuba ZVS-5428 VL-bus-card video controller with 1MB DRAM; Mitsuba F562D 14-inch monitor with a 72-Hz refresh rate at 1,024-by-768. Software: DOS 6.2, Microsoft Windows 3.1. Mitsuba Corp., 800-648-7822, 909-392-2000; fax, 909-392-2021.

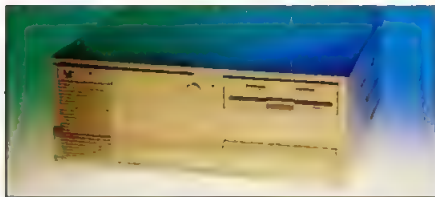
Circle 470 on reader service card

National MicroComputers

NMC Pro-System 466

While the \$2,098 NMC Pro-System 466 is not a performance leader, the 66-MHz PC did perform consistently enough to be considered a good choice for those who use DOS and Windows software.

The NMC Pro-System performed adequately on most of our benchmark tests. The video subsystem, powered by a Tseng ET4000 video chip set, helped this unit achieve above-average scores on our Graphics WinMark and DOS video tests. But the 340MB Western Digital hard disk



and local-bus multifunction hard disk and I/O controller did not help the system on our Disk WinMark and DOS disk tests, where its scores were below average. The system's Winstone and DOSmark scores were respectable, making this a good all-around PC.

The NMC Pro-System includes Power-shift Windows-based energy-conservation software. The unit drew 28.4 watts at full power and 25.6 watts in standby

mode. Its monitor went from 62.3 watts at full power to 14.7 watts in standby mode.

With its decent price, the NMC Pro-System 466 proves to be a solid starter system.—RA

► **NMC Pro-System 466.** List price (tested configuration): \$2,098. Processor/memory: Intel 486DX2/66, 8MB RAM, 256K external cache.

Data storage: Western Digital WDAC2340 340MB IDE hard disk with 128K cache, ECS DI-602 VL-Bus-card disk controller. Display: Hercules Dynamite VL Pro VL-Bus-card video controller with 2MB DRAM; ADI MicroScan 2e 14-inch monitor with a 60-Hz refresh rate at 800-by-600. Software: DOS 6.2, Microsoft Windows 3.11. National MicroComputers, 800-424-2983, 801-265-3700.

Circle 471 on reader service card

NEC Technologies Inc.

NEC Ready 466es

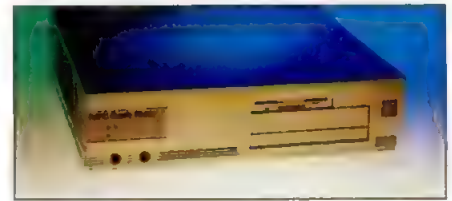
The NEC Ready 466es, the top of NEC's Ready es line, is a bargain at \$1,999. But while the system offers effective power-saving features, its poor performance may dampen its appeal.

The NEC Ready turned in some of the worst scores across the board when compared with other machines using the 486DX2/66 chip. It came in dead last within its system-unit on our processor tests, and its Winstone and DOSmark scores were both well below average.

This unit's power-saving abilities, however, were respectable.

The system-unit power usage dropped from 34.1 watts (full

power) to 24.5 watts (standby mode), and the monitor's usage fell from 70.5 watts to 25.5 watts. The NEC Ready's standby mode has two phases: The first powers



down the monitor upon mouse and keyboard inactivity; the second powers down the hard disk. Either phase can be set off by inactivity intervals of from 1 minute to 1 hour; the user can adjust settings via the AUTOEXEC.BAT file or via a dialog box in the Windows Control Panel. The NEC Ready does not begin timing for the second phase until after the system has entered the first standby mode.

The machine bounced back from standby mode quickly, regaining full computing power almost instantly.—EH

► **NEC Ready 466es.** List price: (tested configuration): \$1,999. Processor/memory: Intel 486DX2/66, 8MB RAM. Data storage: Conner CP30254 251MB IDE hard disk with 64K cache, integrated disk controller with 128K cache. Display: Integrated video controller with 1MB DRAM; NEC JC-1535VMA 14-inch monitor with a 60-Hz refresh rate at 1,024-by-768. Software: DOS 6.2, Microsoft Windows 3.1, America On-Line, CompuServe. NEC Technologies Inc. PFS: Windows Works, 800-388-8888, 508-264-8000; fax, 508-264-8673.

Circle 472 on reader service card

NETis Technology Inc.

NETis 486 VESA Green PC

The \$2,499 NETis 486 VESA Green PC is a solid desktop system with average performance that may be best for undemanding users. There are less expensive DX2/66-based systems in this roundup that fit that description, too.

Energy Star compliance is ensured through the system's AMI BIOS. In standby mode, system-unit power usage fell from 38.9 to 26.2 watts, and the monitor shut off (peak power use was 86.8 watts). System board and monitor time-out can occur after 1 to 255 minutes of inactivity.

► NEC Ready 466es

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	FAIR
Expandability	FAIR
Power efficiency	POOR
VENDOR SERVICE & RELIABILITY	
Reliability	AVERAGE
Repair service	BELOW AVERAGE
Technical support	BELOW AVERAGE

More

More

\$1,999* (IBM Credit Lease \$72/mo **)

[illegible]

portable.

IBM.



ThinkPad 350C

affordable.

ThinkPad 350C (color)

- 486SL, 25MHz processor with 8KB internal cache
- 4MB RAM/250MB hard drive, 3.5" 1.44MB diskette drive
- 11.7" w x 8.3" d x 2.0" h/5.7 lbs with battery pack
- 9.2" STN backlit LCD, 256-color display
- Full-size keyboard w/integrated TrackPoint II
 - PCMCIA slot
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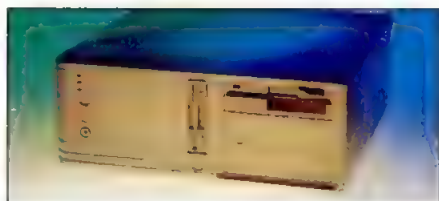
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This system's test scores were unremarkable. The processor score was lower than most of the DX2/66-based systems we tested. The local-bus controller, with 2MB of disk cache, did not help this unit's hard disk performance under either DOS or Windows; the system turned in lower DOS disk and Disk WinMark scores than did the DX2/50-based DECpc LPv+, which used an integrated controller and no cache. Furthermore, this unit, with a Cirrus

not fare well on our benchmark tests, primarily because of its video controller, a Chips & Technologies chip normally found on laptops. Though its processor score was high for its CPU class, the PC&C Iguana finished last on both the DOS video and Graphics WinMark tests; it also got the lowest Winstone and one of the lowest DOSmark scores in the roundup.

PC&C Iguana EG-2000

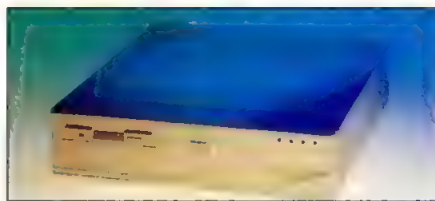
SUITABILITY TO TASK	
DOS applications	FAIR
Windows applications	FAIR
Expandability	POOR
Power efficiency	EXCELLENT

The PC&C Iguana does excel, however, in terms of power savings. It offers two levels of shutdown: When inactive for a user-definable period of time, it automatically descends from peak mode into normal

mode, cutting power consumption. After a second-level user-set period of inactivity, it enters standby mode, in which all components are shut down. In standby mode, the system unit's power usage decreased to a scant 5.4 watts (at full power, it used 21.8 watts), and the monitor's usage decreased to 13.4 watts (at full power, the monitor used 66.7 watts). The machine recovered full power from standby mode almost instantly.

The fact that the PC&C Iguana has only one drive bay shows that with this system, power conservation takes priority over expansion. But clearly the system's ability to save power is outstanding.—EH

► **PC&C Iguana EG-2000.** List price (tested configuration): \$2,045. Processor/Memory: Intel 486DX/33, 8MB RAM. Data storage: Western Digital Caviar 1210 203MB



IDE hard disk with 32K cache, integrated disk controller. Display: Integrated local-bus video controller with 1MB DRAM, Tatung VM3401P 14-inch monitor with a 60-Hz refresh rate at 800-by-600. Software: DOS 6.2, Microsoft Windows 3.1. PC&C Research Corp., 800-843-1239, 805-484-1685; fax, 805-987-8088.

Circle 474 on reader service card

NETis 486 VESA Green PC

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	FAIR
Power efficiency	FAIR

Logic-based Genoa video controller, performed poorly on our Graphics WinMark tests, although it redeemed itself on our DOS video tests.

Competing with several sys-

tems in the roundup that offer as much for less, this unit is more appropriate for DOS users than for Windows users.—BF

► **NETis 486 VESA Green PC.** List price (tested configuration): \$2,499. Processor/memory: Intel 486DX2/66, 16MB RAM, 128K external cache. Data storage: Western Digital Caviar 2340 340MB IDE hard disk with 64K cache, Promise DC-4030VL VL-Bus-card disk controller with 2MB cache. Display: Genoa Systems Corp. 8500VL VL-Bus-card video controller with 2MB DRAM; Video Magic CA-1565C 15-inch monitor with a 72-Hz refresh rate at 1,024-by-768. Software: DOS 6.0, Microsoft Windows 3.1. NETis Technology Inc., 800-577-7526, 408-263-0368; fax, 408-263-4624.

Circle 473 on reader service card

PC&C Research Corp.

PC&C Iguana EG-2000

If you want to save energy and don't need blazing performance, the \$2,045 PC&C Iguana EG-2000 may be your best bet.

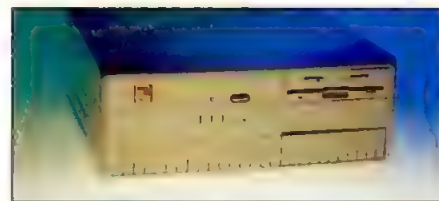
Unfortunately, this 33-MHz system did

Polywell Computers

Poly 486GPC

Polywell's \$2,350 Poly 486GPC is a solid performer with some well-thought-out power-saving features.

The energy-saving features of the



Polywell Poly are controlled by the AMI BIOS setup which lets you modify time-out for the motherboard, monitor, and Western Digital 340MB hard disk separately. At full power, the system unit used 33.7 watts, dropping to 21.4 watts at idle. At full power, the monitor used 62.8 watts; at idle, 14.1 watts. Since all the power features are controlled via the motherboard, you can install any video card and up to four hard disks, and the power-saving features will still function.

The Polywell Poly earned one of the top Graphics WinMark scores in the roundup and had an above-average Disk WinMark score. It also had an above-average DOSmark score,

in part because of solid performance on DOS video tests. This 486DX2/66-based system came with 8MB of RAM and 256K of external cache, which helped it to turn in an average Winstone score.

The Poly 486GPC was an all-around decent performer that offered a little extra customizability in terms of its power-conservation features. It is an attractive system for the user who wants a green PC with expansion potential.—MD

► **Poly 486GPC.** List price (tested configuration): \$2,350. Processor/memory: Intel 486DX2/66, 8MB RAM, 256K external cache. Data storage: Western Digital Caviar 2340 340MB IDE/LB hard disk with 128K cache, integrated disk controller. Display: Actix UltraGraphicEngineVL VL-bus-card

Poly 486GPC

SUITABILITY TO TASK	
DOS applications	EXCELLENT
Windows applications	GOOD
Expandability	GOOD
Power efficiency	FAIR

video controller with 2MB VRAM; ADI MicroScan 3E 14-inch monitor with a 60-Hz refresh rate at 1,280-by-1,024. Software: DOS 6.2, Microsoft Windows 3.1. Polywell Computers, 800-999-1278, 415-583-7222; fax, 415-583-1974.

Circle 475 on reader service card

Tagram System Corp.

Tagram V-Line CD/Green

Buyers looking for a well-equipped, expandable, energy-conscious system: Look no further. Tagram System Corp.'s \$2,059 Tagram V-Line CD/Green combines a DX-2/66 CPU, Panasonic double-speed CD-ROM drive, and roomy mini-tower case with an attractive warranty and solid performance.



At full power, the Tagram V-Line's system unit and monitor consumed 36.2 and 75.4 watts of power, respectively. With power conservation features enabled, the system unit drew 27.1 watts, and the monitor used a mere 0.4 watts. Power conservation settings are controlled either through the AMI BIOS or through BCM Advanced Research's

Tagram V-Line CD/Green	
SUITABILITY TO TASK	
DOS applications	EXCELLENT
Windows applications	GOOD
Expandability	FAIR
Power efficiency	FAIR

Windows-based Energy Saver Program. The user can set the hard-disk to turn off after up to 21 minutes of inactivity (in 1-minute increments); system-unit and monitor time-outs can be

set for up to 120 minutes of inactivity (in 1-minute increments).

On PC Labs' benchmark tests, the Tagram V-Line performed exceptionally well. Its scores on all tests ranged from average to above average for its CPU class, and its DOS video score was the best among all tested systems.—Carol Venezia

► **Tagram V-Line CD/Green.** List price (tested configuration): \$2,059. Proces-

sor/memory: Intel 486DX2/66, 8MB RAM, 256K external cache. Data storage: Western Digital Caviar 2420 425MB IDE hard disk with 128K cache, BCM Advanced Research GP4530 VL-Bus-card disk controller, Panasonic CR-562B CD-ROM drive. Display: BCM Advanced Research GP4530 VL-Bus-card video controller with 2MB DRAM; OptiQuest 2000DC Green 13.5-inch monitor with a 72-Hz refresh rate at 1,024-by-768. Software: DOS 6.0, Microsoft Windows 3.1. Tagram System Corp., 800-824-7267, 714-258-3222; fax, 714-258-3220.

Circle 476 on reader service card

Tangent Computer

Tangent VLe 466

With exceptional DOS video and Graphics WinMark scores, the \$2,198 Tangent VLe 466 is a high-end graphics system at a fair price. Unfortunately, performance was marred by a poor Winstone score.

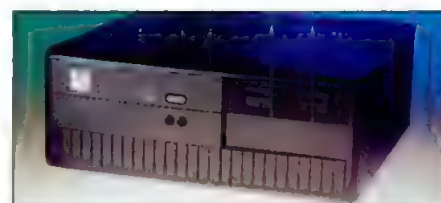
In standby mode, the system unit used 29.7 watts of power; the monitor shut off in standby mode (its peak power usage was 70.6 watts). Power management settings are controlled through the unit's AMI BIOS and can be accessed at boot-up with a keystroke. The system's options include separate time-out settings for the monitor and motherboard; either time-out can occur at intervals of inactivity ranging from 15 minutes to 2 hours. The hard disk time-out can be engaged after from 1 minute to 15 minutes of disuse.

DOS performance was highlighted by a solid processor score and exceptional DOS video performance, aided by the system's Hercules Dynamite card, which uses the Tseng ET4000 chip set. This unit also posted an outstanding Graphics WinMark score, making it an all-around winner in both the DOS and Windows arenas. Unfortunately, the system's DOS disk and Winstone scores were among the lowest of the DX2/66-based units in this roundup.

With the Tangent VLe, Tangent has put together an energy-saving, high-end

graphics station at a budget price.—BF

► **Tangent VLe 466.** List price (tested configuration): \$2,198. Processor/memory: Intel 486DX2/66, 8MB RAM, 256K external cache. Data storage: Seagate ST3290A



260MB IDE/LB hard disk with 64K cache, Tyan S1337/39-001-02 VL-Bus-card disk controller. Display: Hercules Dynamite VL Pro VL-Bus-card video controller with 2MB DRAM; ADI SM-5514AP 14-inch monitor with a 70-Hz refresh rate at 1,024-by-768. Software: DOS 6.2, Microsoft Windows 3.1. Tangent Computer, 800-800-5550, 415-342-9388; fax, 415-342-5937.

Circle 477 on reader service card

Tri-Star Computer Corp.

Tri-Star ESPC DX-2

Tri-Star Computer Corp.'s entry into the green-PC arena is the \$2,490 Tri-Star ESPC DX-2, a slimline DX2/66-based system. But though it may lower your electric bill, its performance on our benchmark tests was disappointing.

Power-saving settings are controlled through Windows' screen-saver utility; future models will allow you to change settings through a newer version of the system's Phoenix BIOS. In standby mode, the system unit powered down to just under 29 watts; its Nanao FlexScan monitor powered down to just under 4 watts when the front-mounted Power Save button was pushed. You activate this button only once, and thereafter, it puts the display on standby when the screen saver activates.

The Tri-Star

Tangent VLe 466	
SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	FAIR
Expandability	GOOD
Power efficiency	FAIR

Tri-Star ESPC DX-2	
SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	FAIR
Expandability	GOOD
Power efficiency	FAIR
VENDOR SERVICE & RELIABILITY	
Reliability	AVERAGE
Repair service	AVERAGE
Technical support	AVERAGE

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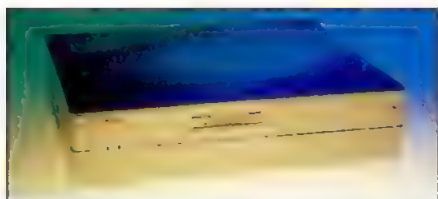
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Lotus
Working Together

ESPC was a below-average performer in its CPU class. This system seems to be crippled by integration: Both video and disk controllers are integrated on the motherboard, which may save money and expansion slots but leaves the Tri-Star ESPC at the starting line when other systems with more powerful add-in local-bus cards take off.

Tri-Star backs this system with a two-year parts, lifetime-labor warranty, with one-year of on-site service included.—CV

► **Tri-Star ESPC DX-2.** List price (tested configuration): \$2,490. Processor/memory: Intel 486DX2/66, 8MB RAM, 128K external cache. Data storage: Western Digital Caviar 2340 324MB IDE hard disk with 64K cache, integrated disk controller. Display: Integrated local-bus video controller



with 512K DRAM; Nanao FlexScan F340-iW 15-inch monitor with a 70-Hz refresh rate at 1,024-by-768. Software: DOS 6.0, Microsoft Windows 3.1. Tri-Star Computer Corp., 800-755-1000, 602-961-3401; fax, 602-961-4010.

Circle 478 on reader service card

Ultra Computers

Ultra UL-486/66-LPC

Although Ultra Computers' DX2/66-based Ultra UL-486/66-LPC may offer a lot on paper, it doesn't deliver high performance. At a price of \$2,211, this unit does little to distinguish itself from the pack.

Remove the cover from this full-desktop PC and its seemingly roomy appearance is immediately marred by a sea of wires and cables, which make access to its upgradable system unit difficult. And while its system memory may be expandable to 64MB, all eight SIMM

banks are full, and half of them are blocked by the power supply. Add poor documentation to this picture and you have a rather unfriendly system.

The Ultra LPC achieves Energy Star



compliance through its AMI BIOS setup utility. Users can set screen-saver, system-board, and suspend-mode timer options in 2- through 10-minute intervals, up to 250 minutes total. These settings allowed the system unit to power down to 21.4 watts in standby mode from nearly 30 watts at full power; the monitor's power dropped to 0 watts from 60.7 watts.

On our benchmark tests, the Ultra UL-486/66-LPC did not stand out within its

*The seemingly roomy
appearance is marred
by a sea of wires
and cables, which makes
access difficult.*

CPU class. Overall performance was barely average, and processor and Graphics WinMark test scores were particularly disappointing. The system's only bright spots were on DOS video and DOS disk tests.—CV

► **Ultra UL-486/66-LPC.** List price (tested configuration): \$2,211. Processor/memory: Intel 486DX2/66, 8MB RAM, 128K external cache. Data storage: Western Digital Caviar 2420 424MB IDE hard disk with 128K cache, MicroLink HLC-3000SP VL-Bus-card disk controller. Display: Diamond SpeedStar Pro VL VL-Bus-card video controller with 1MB VRAM; Kenitec 215AX 14-inch monitor with a 72-Hz refresh rate at 1,280-by-1,024. Software: DOS 6.2, Microsoft Windows 3.1. Ultra Computers, 800-755-7518, 304-748-0273; fax, 304-748-0276.

Circle 479 on reader service card

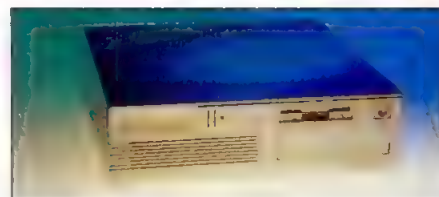
Unisys Corp.

Unisys PW² Advantage Partner ELI 4333

With consistently poor performance on our benchmark tests and a comparatively high price for a DX/33-based system, the \$2,481 Unisys PW² Advantage Partner ELI 4333 will face an uphill battle in today's competitive PC market.

This system is Energy Star-compliant even at full power, drawing only 29.9 watts. In standby mode, system-unit power usage drops to 24.1 watts, while the monitor powers down from 61.8 watts to 2.3 watts; power savings are manipulated through the AUTOEXEC.BAT file. One setting shuts down the monitor and the hard disk at timed intervals of 1 to 59 minutes. This unfortunately does not allow the monitor to stay on longer than the hard disk.

The Unisys PW² performed poorly under DOS: Its processor, disk, and DOS-mark scores were the lowest in its processor class. Windows performance was marked by the lowest Disk WinMark score and a second-to-last-place Winstone score. The brightest spot was a mediocre performance from the S3-based video subsystem, which at least brought



the system out of the benchmark test-basement on DOS video and Graphics WinMark tests.

These days buyers want more for less. The Unisys PW² just doesn't offer

Ultra UL-486/66-LPC	
SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	FAIR
Power efficiency	GOOD

Unisys PW ² ELI 4333	
SUITABILITY TO TASK	
DOS applications	FAIR
Windows applications	FAIR
Expandability	FAIR
Power efficiency	GOOD
VENDOR SERVICE & RELIABILITY	
Reliability	AVERAGE
Repair service	AVERAGE
Technical support	AVERAGE

enough bang for the buck when compared with most systems in this roundup.—*BF*

► **Unisys PW² Advantage Partner ELI 4333.** List price (tested configuration): \$2,481. Processor/memory: Intel 486DX/33, 16MB RAM. Data storage: Quantum ProDrive LPS 244MB IDE hard disk with 256K cache, integrated disk controller. Display: Integrated video controller with 1MB DRAM, Unisys EVG-300-COL 14-inch monitor with a 60-Hz refresh rate at 800-by-600. Software: DOS 6.0, Microsoft Windows 3.1. Unisys Corp., 800-874-8647 (ext. 912), 215-986-4011; fax, 215-986-6850.

Circle 480 on reader service card

United Solutions Inc.

USI Green PC

United Solutions' \$1,745 USI Green PC was not one of the fastest 486DX2/66-based systems tested, but for a low price you get effective power management and

USI Green PC	
SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	FAIR
Power efficiency	FAIR

adequate performance under both DOS and Windows.

In sleep mode, the USI Green PC's system-unit power consumption dropped from 33.8 to 25.9 watts, and the at-

tached Optquest 1500DX monitor consumed 77 watts at full power, and shut off at idle. A DOS and Windows Viewsonic utility program is used to set video suspend or shutdown time for Energy Star-compliant monitors; the AMI BIOS setup sets echo delays for system-unit slowdown and for hard-disk and auxiliary

recover from shutdown.

The USI Green PC's mixed test scores were due to a relatively slow 245MB Maxtor hard disk with a cacheless IDE controller, which kept this unit's DOS disk score low, and a Tseng ET4000/W32i chip-based video board, which contributed to above-average scores on both DOS video and Graphics WinMark tests.

For its price, the USI Green PC is a

*The USI Green PC
is a good deal, with
flexible, effective power
management—as long
as you don't need a fast
hard disk.*

good deal, with flexible, effective power management—as long as you don't need a fast hard disk.—*BB*

USI Green PC. List price (tested configuration): \$1,745. Processor/memory: Intel 486DX2/66, 8MB RAM, 256K external cache. Data storage: Maxtor 7245AT 245MB IDE hard disk with 64K cache, USI 32-bit Winbond Chip VL-Bus-card disk controller. Display: USI RT4000 W32i VL-Bus-card video controller with 2MB DRAM; OptiQuest 1500DX 14-inch monitor with a 72-Hz refresh rate at 1,024-by-768. Software: DOS 6.2, Microsoft Windows 3.1. United Solutions Inc., 800-653-0001, 310-645-3232; fax, 310-645-0044.

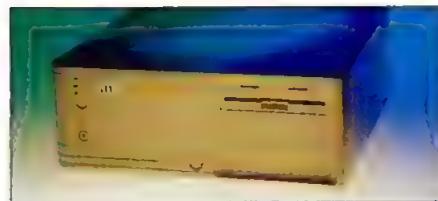
Circle 481 on reader service card

Unitek Technology Inc.

UT-486DX2/66LBES

Unitek Technology's \$2,135, small-footprint UT-486DX2/66LBES doesn't measure up to many other tested systems, because of its slow performance and limited though adequate power management functions.

A simple Viewsonic Windows utility sets monitor power suspension or shutdown, but you must use a relatively prim-



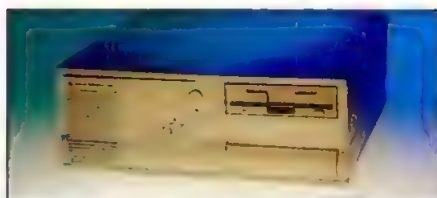
itive DOS utility to edit a text file with settings to slow the system unit to 8 MHz and spin down the hard disk. Both utilities are effective, however, dropping system-unit power consumption from 30.7 to 21.7 watts, and the Viewsonic 15 monitor's power consumption from 91.1 to 0 watts. The system beeps when power is reduced or restored. All components are restored to full function quickly.

The Unitek UT was an uninspiring performer on benchmark tests, with relatively low scores on DOS disk and Disk WinMark tests, due in part to the cacheless VL-Bus Shuttle IDE controller, which was paired with a Western Digital 341MB hard disk. The only performance highlight was a good DOS video score, thanks to a Genoa Systems Cirrus Logic chip-based local-bus video board. This unit did not perform well on our Graphics WinMark tests.

Acceptable DOS video performance is not enough reason to buy this system, which could benefit from a better hard disk setup and a more modern power management utility.—*BB*

► **UT-486DX2/66LBES.** List price (tested configuration): \$2,135. Processor/memory: Intel 486DX2/66, 8MB RAM, 256K external cache. Data storage: Western Digital Caviar 2340 341MB IDE/LB hard disk with 128K cache, Shuttle IDE/VLB VL-Bus-card disk controller. Display: Genoa Systems WindowsVGA 24 8500VL VL-bus-card video controller with 1MB DRAM; Viewsonic 15 (1564-M) 15-inch monitor with a 76-Hz refresh rate at 1,024-by-768. Software: DOS 6.0, Microsoft Windows 3.1. Unitek Technology Inc., 800-944-5650, 909-930-5700; fax, 909-930-5710.□

Circle 482 on reader service card



power-outlet shutdown. You can plug a nongreen monitor into the auxiliary outlet to conserve power. A sleep button on the case front cuts power immediately. The system powers up quickly from suspend mode, but it takes a few seconds to

UT-486DX2/ 66LBES

SUITABILITY TO TASK	
DOS applications	FAIR
Windows applications	FAIR
Expandability	GOOD
Power efficiency	FAIR

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CIRCLE 079 ON READER SERVICE CARD

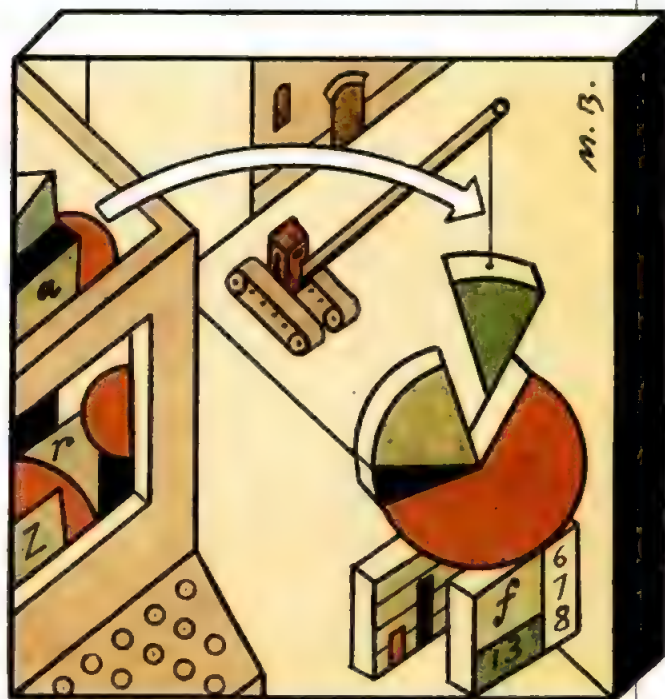
The Works:

Not *Just* for Beginners Anymore

Today's best low-cost integrated packages provide features sophisticated enough for all but the most specialized computing needs. Best of all, their integration is finally second to none.

By *Steve Gilliland*
& *Ted Stevenson*

Since integrated software packages first appeared—not long after the first PCs, in fact—concepts of what these packages should be have fluctuated almost as regularly and as radically as hemlines. When we last examined the category 18 months ago, the old guard—represented by such products as Enable Software's Enable, Borland International's Framework, and Lotus Development Corp.'s Symphony—was on its way out. Those products, which emphasized power over ease of use, were being overtaken by a new order: products slinging watchwords like simplicity and usability. Today, power is on the upswing again, and this time it's not sacrificing a thing.



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EDITORS' CHOICE

- **Microsoft Works for Windows**

This turnabout is no accident: Today's developers conduct thorough market research and apply their findings to the process of product design. As a result, the products accurately reflect the profile of real-world users. One significant discovery is that users of low-cost integrated software are by no means all computer novices in need of training wheels. In a 1993 survey commissioned by Microsoft Corp., nearly a third of Microsoft Works users ranked themselves as experts in computer experience. More than half said they concentrated on a combination of personal work and office work brought home and on personal tasks and small- or home-office tasks. Furthermore, 66 percent had modems. Also, most users said they needed to accomplish a wide variety of tasks using the full range of applications. Around 65 percent of respondents depended on compound-document creation for their work, regularly linking charts, graphics, and tables to their word processors.

To serve the needs of such users, an integrated package must have sufficient features and power to accommodate "grown-up" work. Users can measure a toolkit's productivity by the accessibility of its features, transparency of its power, and integration of its applications. Integration, ease of learning, and ease of use can therefore be seen as critical to success.

GRAPHICAL EDGE

Roughly half of the programs in our 1992 roundup of low-cost integrated packages were DOS-based. While character-based programs can certainly support serious work in any application category, they concede some great advantages to programs with graphical interfaces, since the latter are inherently easier to use and integrate. For these reasons, we have chosen in this roundup to focus our attention exclusively on Windows- and OS/2-based products.

To be included here, a product needed to offer word processing, spreadsheet, and database components, as well as a component dedicated to graphics (or charting) or telecommunications. It also had to have been introduced or significantly upgraded since our last roundup

In many software-application categories, the number of new or upgraded products has begun to decline sharply. Not so in the case of integrated software. When we last reviewed products in this category 18 months ago, our crystal ball showed us an expanding market. Counting

only those entries with graphical interfaces, there have been three new packages born since (and a fourth is on the way). Their emergence seems to bear out our prediction.

Our Editors' Choice selection, however—Microsoft Works for Windows, Version 3.0—is by no means a newcomer. Version 2.0, in fact, captured the same honor in our 1992 roundup. Microsoft Corp. has taken a good product and made it even better. This new version achieves superior integration, thanks to a more carefully designed interface and a polished implementation of OLE 2.0. Furthermore, a genuine telecommunications module closes a significant gap in the package's previous version. (Communications continues to increase in importance among users at all levels, but this is an area in which many integrated packages lag sadly behind the times.) Those who need more power than

Microsoft Works provides can make a relatively smooth transition to Microsoft Word and Microsoft Excel—the company's mainstream word processor and spreadsheet packages.

Finally, Microsoft has bolstered the number and power of the Wizards supplied (the package's automated task aids) and has added copious tutorial files to ease the pain of learning the package. Microsoft Works is clearly the best endowed of all the products here—at least in terms of richness of features and depth of computing power. It may not, however, be every buyer's choice.

We must give honorable mention to one of the category's standouts: ClarisWorks for Windows, Version 1.0. ClarisWorks blazes a new and distinctive trail in these woods. Unlike all of its competitors, it rejects the established multimodule format (separate word processor, spreadsheet, database, graphics, and communi-

and have a list price of \$250 or less. Our lineup includes ClarisWorks for Windows, Version 1.0; Footprint Works for OS/2, Version 1.01; Microsoft Works for Windows, Version 3.0; PFS:WindowWorks, Version 2.02; and PushButton Works for Windows, Version 3.0. PushButton breaks new ground with its under-\$50 price tag. Slated for release sometime in the second quarter of 1994 but not available in time for this roundup was Version 2.0 of WordPerfect Works for Windows.

POWER POLITICS

The power of these packages doesn't rival the power of the office suites we reviewed in February of this year: Borland Office for Windows, Lotus SmartSuite for

Windows, and Microsoft Office Professional. Those suites differ from these low-cost packages in much the same way that a professional mechanic's tool chest might differ from the one in your garage: The pro's set is likely to be both more extensive and job-specific. Even so, the differences between low-cost integrated software and those collections of top-of-the-line applications from the industry's leading vendors aren't nearly as great as they were 18 months ago.

Each product's word processor provides much more than basic editing prowess and includes all of the tools that we have come to regard as essential to the writing process (such as a spell-checker, a thesaurus, and flexible search-and-replace features). All provide reasonably hassle-

Low-Cost Integrated Software

cations modules) in favor of a beautifully integrated approach in which all stages of creating a compound document take place in the context of a single page or workspace. ClarisWorks is clearly the most document-centered package in this roundup.

Furthermore, ClarisWorks has more prowess in graphics, drawing, sophisticated document design, and formatting than any of its competitors—crossing into the realm of low-end desktop publishing. If and when Claris Corp. gets around to adding a true communications facility and smoothing out a few of the rough edges that are almost inevitable in a first-generation product (the lack of unbalanced columns or the inability to hot-link charts built into the spreadsheet space to documents created in the word processor, for example), it will definitely be a most formidable contender.

We are pleased to have an integrated entry for the OS/2 platform in our roundup. Footprint Works for OS/2 is a reasonable albeit buggy beginning and incorporates nice touches like drag-and-drop editing and data sharing. We encourage Footprint Software to make the needed improvements and provide OS/2 fans with a package worthy of the platform.

free control over scalable type. Also, all let you easily drop or paste a graphics image directly onto a page, and most allow text to flow around it automatically (ClarisWorks' compound-document format can't handle text wraparounds, but the package does allow for easy placement of graphics within frames on a page).

Each product can decorate and annotate pages with vector drawing tools; some can even perform decorative graphical manipulation of type. Microsoft Works relies on Microsoft's Draw utility,

but each of the other products offers line, arc, box, and oval drawing built in. ClarisWorks, with its Macintosh origins, offers the widest array of drawing tools, adding variable pen tips, color, and commands that let the user rotate, flip, align, and group objects. Footprint benefits from the OS/2 drawing and charting utility from Micrografx.

The spreadsheets in these packages support more complex layouts than their older brethren. There's an increased number of functions; ClarisWorks, for example, features more than 100, rivaling many standalone spreadsheets. Each package has at least 46 functions, providing no fewer than 20 math and analytical operations and at least 6 business and financial formulas. Footprint and PushButton let you add hidden notes to cells. And add a point for compatibility: The reviewed packages let you import and export in .XLS and in .WK1 formats.

NOT-SO-GREAT COMMUNICATORS

Many users these days plan to cruise the information highway, and all of the packages here but one—PushButton—recognize this in some fashion. PushButton doesn't support modem transfer of any kind, while ClarisWorks still relies on the meek Windows Terminal accessory. But the Microsoft Works communications module, new with Version 3.0, now supports scripting, a "learn" mode for creating new log-on scripts, and several protocols (though not CompuServe B). Footprint relies on the OS/2 communicator utility, a considerably more powerful module than the Windows Terminal. OS/2 also offers scripting, learn-by-keystroke scripts, and multiple protocols.

Portability—the ability to work on a notebook—is more of an issue than ever before. The greediest of these packages occupies far less disk space than an equivalent combination of standalone applications. ClarisWorks needs less than 4MB for a full installation, while Microsoft Works demands 14MB. Maximum disk

usage for the others ranges from 8MB to 11MB.

If disk space is tight, most of the programs can shed some weight. Microsoft Works—without Wizards, CueCards, a spell-checker, and other accessories—can drop to 4MB. PushButton can drop from 8MB to 6MB, and PFS:WindowWorks from 11MB to 6MB. Only Footprint, at 8MB, offers no installation smaller than the complete package.

INTEGRATION INNOVATION

Application integration today is a distinguishing mark of a well-designed package. Potential users should look for interface consistency, which makes a product easy to learn and use, and easy and flexible data sharing, which makes a product more powerful.

A consistent interface—with, for example, the same menus and icons in the same places in each component of the program—can eliminate much unnecessary complication in working with multimodule software packages. This fairly new idea has already taken hold in the best of this year's crop.

The Windows Clipboard (and its equivalent in both name and function in Footprint) provides simple and effortless data sharing among application components, but even this doesn't exhaust the full data-interchange potential inherent in these GUI environments. Of the five packages here, only Microsoft Works implements the latest open standard for interapplication data sharing: OLE 2.0. OS/2 itself hasn't reached the object- and data-interchange level of OLE 2.0, but IBM is expected to announce OLE capability before June.

PFS:WindowWorks and PushButton both support OLE 1.0, and Footprint, Microsoft Works, and PushButton make use of DDE.

Then there's ClarisWorks, which employs neither DDE nor OLE technology. It offers instead a proprietary technique for managing embedded objects, putting it in a class by itself. All elements in the word processor, spreadsheet, and graphics modules are created and edited in a single integrated document space. Besides essentially eliminating all data-sharing issues, ClarisWorks' integration also makes for a high degree of interface con-

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Low-Cost Integrated Software

Suitability to Task:**Low-Cost Integrated Software**

As developers add more and more power to low-cost integrated software packages, solid data-sharing tools and healthy feature sets become increasingly available for all users. At the same time, users are now opting less for dedicated packages and more for supplements to their favorite stand-alone applications, making integration a high priority.

We rated these five packages on the efficiency of their word processor, spreadsheet, database, graphics, and communications modules, homing in on specific tasks that the casual or novice user would typically perform. We compared these packages' abilities to complete different tasks with the corresponding abilities of full-featured stand-alone packages dedicated to the same work. We also rated the integration capabilities of each package.

Ratings are given for power (which reflects a package's range of features) and ease (which reflects the simplicity of the package's design and the help it provides for completing these tasks).

Under **word processor**, we evaluate each

SUITABILITY TO TASK		
Product Name	POWER	EASE
Word processor	Poor	Poor
Spreadsheet	Fair	Fair
Database	Good	Good
Graphics	N/A	N/A
Communications	N/A	N/A
Integration	Excellent	Excellent

N/A—Not applicable. An N/A for **graphics** means the product's graphics module is used only for charting; an N/A for **communications** means the package does not have a built-in communications module.

package's ability to perform a mail-merge and print envelopes and mailing labels. We also look at the package's spell-checker and thesaurus. To receive a high score, a word processor module needs to have modifiable templates and good formatting and layout features, such as style creation, outlining, and text wrapping. Support for bullets, tables, and multiple columns is also important.

We look at each **spreadsheet** module's function and macro support, chart creation, auditing features, and sorting and formatting options. High scores go to packages that support myriad functions and formatting capabilities.

We examine how well each **database** module lets users create and format database tables, run and save queries, create reports, and execute backups. High scores go to products that provide modifiable templates, support multiple field types, and offer flexible reporting and report-layout features.

For **graphics**, we look at each package's drawing tools, its file import and export types, and its clip-art library (wherever one exists). We also look at the package's ability to let the user modify graphics elements. We evaluate only those graphics modules that offer something more than charting capabilities.

We rate each **communications** module's scripting support, modem support, and transfer protocols. In three of the reviewed packages, communications support is provided only via the operating system.

We rate how well each package supports **integration** among modules, as well as how well it supports integration with other products. To receive a high score, a package should let users share data easily among modules and should support a good variety of external file formats. A high-scoring package should also let users working within documents share information easily with other packages—via OLE, DDE, or a similar technique.

sistency, since there is—in effect—just one screen showing during most document-creation chores.

Most of these packages support MDI (Multiple Document Interface), which allows more than one document to be open and editable on-screen at once. Microsoft Works and Footprint add another dimension to MDI by letting users drag and drop data between open documents—even between modules.

EASY DOES IT

Vendors used to assume that a customer would jump through whatever hoops necessary to learn their software products. Those days are long gone; practically every vendor of mainstream business apps aims to polish ease-of-learning tools, and vendors of low-cost integrated packages are certainly no exception.

Microsoft, for instance, provides while-you-watch working examples of certain activities. Microsoft Works offers examples of spreadsheet recalculations and cut-and-paste functions, as well as explanations of word processor text

manipulations and the difference between numbers and text in a spreadsheet cell. The product's multimedia version even adds animation and sound.

ClarixWorks and PFS:WindowWorks have on-line tutorials, though they aren't as snazzy as Microsoft's. Footprint is positively stodgy, with printed lessons making use of on-line sample files. Only PushButton comes without any on-line learning assistance.

Ease of use, of course, has become an equally serious goal. Well-designed interfaces are essential, as are features such as OLE and drag-and-drop. Microsoft, however, has taken a more energetic course than the other vendors in its quest for ease of use, evidenced particularly by its Wizards, which are nicely dressed macros that handle complex application tasks. Version 3.0 comes with a com-

plement of WorksWizards that automate about a dozen tasks. A mail-merge Wizard not only makes a merge print work the first time but helps create the merge-print database as well. Additionally, with the Letterhead WorksWizard and the help of Clip-

Art, anyone can turn a blank sheet of paper into letterhead.

Today's low-cost, easy-to-learn, integrated GUI packages offer more features and power for less money than ever before. For anywhere from \$49 to \$249 you can get a full suite of tools to handle word processing, spreadsheet, and data-

base operations, as well as the ability to create with ease compound documents embellished with charts, tables, and fancy typography. Racing to keep up with the skyrocketing levels of computer expertise, integrated software is finally meeting the needs of both the novice and the pro.

Many of today's users yearn to cruise the information highway, and all of the packages here but one—PushButton—recognize this in some fashion.

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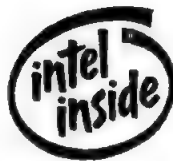
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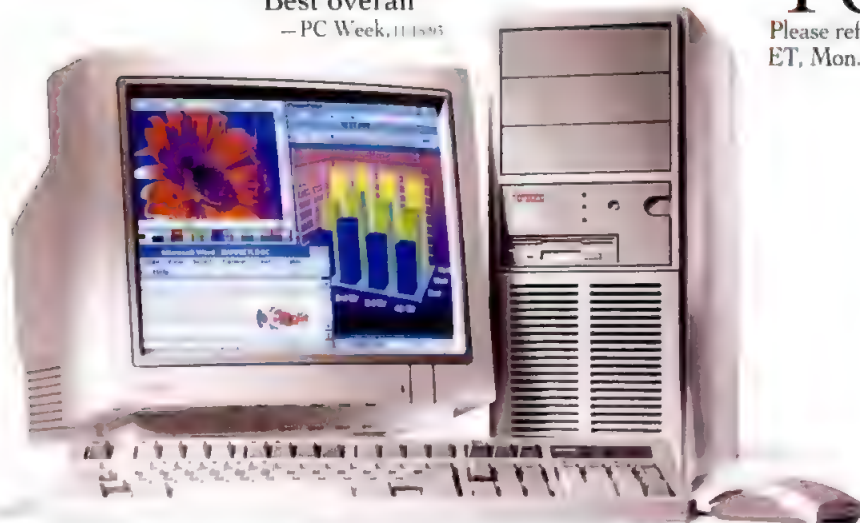
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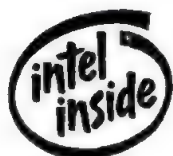
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Beyond the box.

Claris Corp.

ClarisWorks for Windows

BY GREGG KEIZER

Claris Corp.'s ClarisWorks for Windows, Version 1.0, simplifies integration, providing considerable document-layout flexibility. Although the package—\$99 until June 30 and \$249 thereafter—shows some rough edges and lacks the raw power of its primary competitor, Microsoft Works for Windows, its approach to integration is so slick and so natural, you'll wonder why other vendors don't clone its seamless style.

MODULE INTEGRATION

ClarisWorks' word processor, spreadsheet, database manager, and graphics modules add up to a mere 3.8MB in full installation. Although ClarisWorks may look like a traditional integrated package at first, it relies on a unique proprietary integration technique. Rather than requiring you to switch among separate modules to do your work—or use DDE or OLE to create a compound document—ClarisWorks lets you build most documents on a single screen. You access text, spreadsheet, and graphics tools by clicking on an ever-present palette, which automatically mutates the menus at the top of the screen to show that tool's commands. To add a table to a text document, you click on the spreadsheet icon, drag the table's dimensions, and enter data or build a formula; all of ClarisWorks' spreadsheet tools are available.

While these integration tools shine, integrating existing documents can be a bit cumbersome. For example, you can't create a dynamic link between an existing spreadsheet—or a chart built from its data—and the word processor. The product could also use more features with more depth, which would help it better compete with Microsoft's offering.

MORE THAN MEETS THE EYE

ClarisWorks' word processor, though no heavyweight, is more than adequate for the tasks you'd typically ask of an integrated program. It lacks an outliner, can't build memorized styles, and exhibits some Macintosh-style quirks (the Page Up and Page Down keys don't move the cursor, for instance), but as a foundation for compound documents, it's decidedly capable.

The word processor supports up to nine columns, and it lets you insert footnotes and build title pages. Also, it shows context while spell-checking (the spelling and thesaurus tools are available throughout the package). You can use the word processor as the basis for simple desktop publishing; you can link text frames so that copy dropped into one frame automatically flows into the next. The package, though, does not automatically wrap text around images.

You view all details of the document, including headers, footers, and footnotes, on the regular editing screen. To see more of the page, you simply reduce its size with the scaling button; the page can easily and quickly be scaled from 3 to 3,200 percent of its actual size. This makes a print preview mode practically unnecessary, as you can view any number of pages in miniature. And the package's MDI support means you can drag text- and graphics-file icons from the File Manager, drop them onto an open document, and watch them open or import.

Mail-merging is a straightforward process of inserting field names from a ClarisWorks database (you can't merge directly from any other format). Before conducting a merge, you can search database records—for a certain ZIP-code

range, for example. You can then print a subset of the form-letter list. You're on your own when printing envelopes, however, for ClarisWorks offers no help or template in this area.

Text special effects can be built with the graphics tools, and tables and their linked charts can be inserted with the spreadsheet tools. The whole process is incredibly easy. Supported file formats

include ASCII, Microsoft Word for DOS 6.0, Microsoft Word for Windows 2.0, .RTF, and WordPerfect 5.1.

NO LINKS, LOTS OF FUNCTION

ClarisWorks' spreadsheet lacks power-user features, such as

named ranges and advanced formatting capabilities. But it does provide 100 financial, logical, mathematical, and text-oriented functions. It also supports split screens and can conduct multilevel and multicolumn sorts on its data. Only basic formatting and arranging of that data are possible, however, because ClarisWorks can't automatically size columns, and it handles block moves only through manual cutting and pasting.

Creating a chart in ClarisWorks is a snap. Simply highlight the data, click the charting icon on the toolbar, select one of the seven 2-D and 3-D chart styles, then click any of the check boxes to customize the chart. Charts created and kept within the worksheet are hot-linked; that is, they change whenever the underlying data changes. That link breaks when you cut and paste the chart into a word processor document. File formats supported include ASCII, .DBF, .DIF, Microsoft Excel 3.0, SYLK, .WK1, and .WKS.

MOST MAC-LIKE

ClarisWorks' flat-file database is the most Mac-like part of the package, sporting a Rolodex-style icon for record selection. It's capable of handling large tables, even those with as many as 32,000 records, though moving from record to record is somewhat slow.

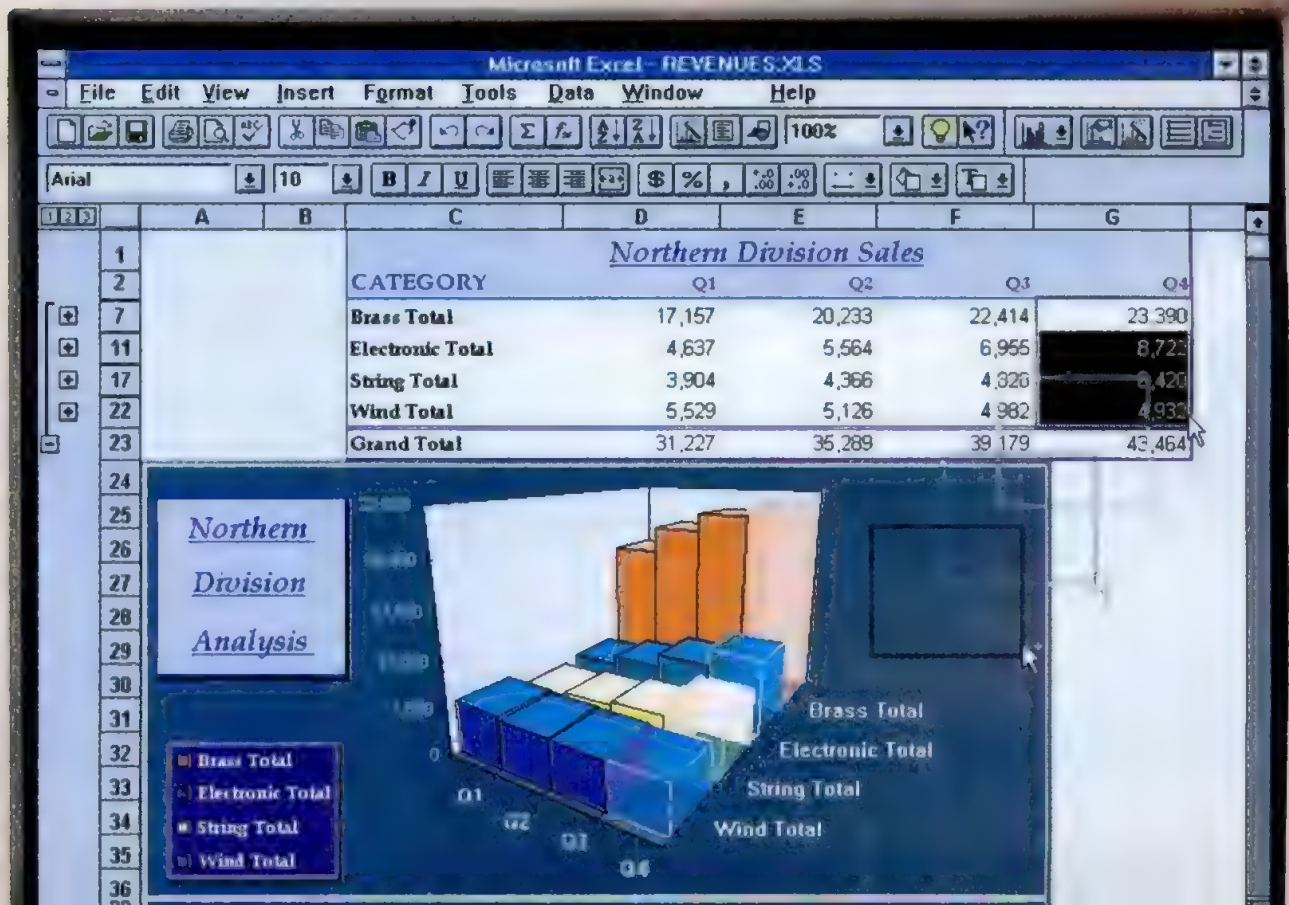
SUITABILITY TO TASK

ClarisWorks for Windows

	POWER	EASE
Word processor	Fair	Excellent
Spreadsheet	Good	Good
Database	Fair	Good
Graphics	Excellent	Excellent
Communications	N/A	N/A
Integration	Good	Excellent

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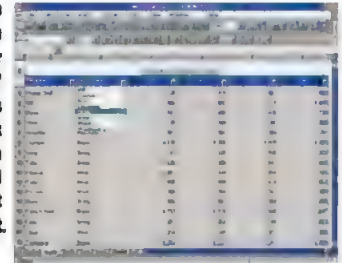
Now with new OfficeLinks, you

never have to leave your work to use any program in the Microsoft Office.

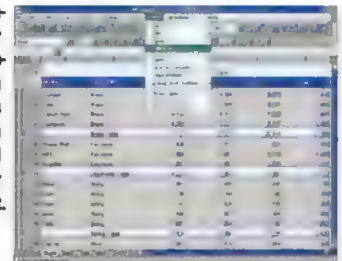
For instance, you can drag and drop a chart into a Word document, click on that chart and have your spreadsheet tools ready to go.

And Microsoft Excel 5.0 introduces Visual Basic® for Applications, the pow-

Want to quickly browse through your information? AutoFilter lets you pick the information you need and filter out the rest.



The Subtotal feature adds your number automatically, then Outlining lets you collapse and expand details of your worksheet.



erful development environment for the Microsoft Office. Now custom business solutions are yours for the making.

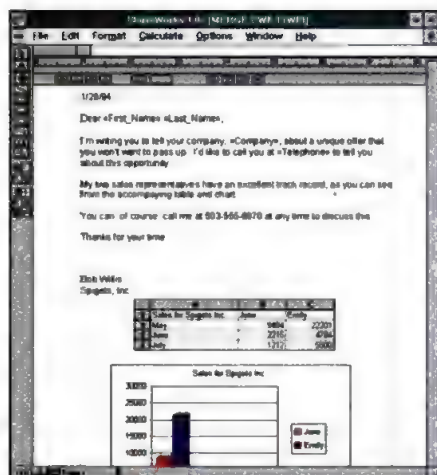
To see why this is the world's most popular spreadsheet, visit your local reseller or call (800) 426-9400, Dept. KU9, to find one near you. Because if you don't have Microsoft Excel 5.0, it's time to raise your standards.



The TipWizard™ assistant tracks the way you work and offers bright ideas on how to save time.

(LEFT) Microsoft Excel works the way you do. Use Drag-and-Plot to instantly update your charts by simply dragging your new data straight in.





In ClarisWorks, the spreadsheet is immediately accessible within the word processor.

Form design and data entry are flexible procedures, if not extraordinarily so. But since the database uses the same toolset as the rest of ClarisWorks, you can enhance a database form with graphics, text frames, and even spreadsheet data if you want. You create such objects by accessing the tool palette, which then mutates the menus accordingly. But you can't create hot links between objects and data held in another document.

Searching and sorting records is particularly easy. You conduct searches in a query-by-form methodology; you enter query strings into a blank record's form. You can't save queries and replay them later, however. Sorts can use several field names for multiple-level sorting—by, say, first state, then name.

ClarisWorks doesn't have a report writer, per se. You customize additional database layouts—including column-style views—in lieu of reports. You can save these layouts and later access them from a menu. Database file formats supported by ClarisWorks include ASCII, .DBF, .DIF, and .SYLK.

ONE FOR TWO

The excellent tools within the graphics module include a complete set of box-, line-, oval-, and arc-drawing tools; pattern, color, and pen selections; and commands to group, align, flip, and rotate objects. You can build compound documents in this environment; ClarisWorks lets you place text and numeric elements

SUMMARY OF FEATURES

Low-Cost Integrated Software



Products listed in alphabetical order	ClarisWorks for Windows	Footprint Works for OS/2	Microsoft Works for Windows	PFS:Window-Works	PushButton Works for Windows
■ = YES □ = NO					
List price	\$99 until June 30, \$249 thereafter	\$149	\$139	\$149	\$49
General Features					
Disk space used in full installation and in minimum installation	3.8MB, 2.3MB	8MB, 10MB	14MB, 4MB	11MB, 6MB	6MB, 6MB
Can act as a shell for other applications	□	□	□	□	□
Network version available	■	■	■	□	□
Integration:					
DDE- and OLE-style links to spreadsheet, database, or graphics module	■ ■ ■	■ □ □	■ ■ ■	■ □ ■	■ ■ ■
Automation through macros	■	■	■ (via Windows)	■ (via Windows)	■
Windowing capabilities:					
Maximum number of active windows, modules	Unlimited, 5	Unlimited, unlimited	8, unlimited	50, 7	Unlimited, unlimited
File handling:					
Copies, moves, and renames files	□	□	■	□	□
Performs automatic backups	□	□	□	□	□
Other operations	None	None	Preview	File deletion	None
Device support:					
Math coprocessor	■	■	■	■	■
Color or PostScript printer	■	■	■	■	■
HP LaserJet and compatibles	■	■	■	■	■
Help:					
On-line tutorial	■	□	■	■	□
Automated helpers	□	□	■	□	□
Cue-card-style help	□	□	■	□	□
Word Processor					
Screen display:					
Format ribbon for choosing font and text attributes	□	■	■	■	■
Draft mode	□	■	■	■	■
Variable zoom levels	■	□	■	■	■
Facing pages	■	■	□	□	■
Multipage thumbnails	■	□	□	■	■
Page layout and text formatting:					
Tab and margins set from ruler	■	■	■	■	■
Indents first line of paragraph	■	■	■	■	■
Indents entire paragraphs	■	■	■	■	■
Columns:					
Maximum number of sneaking, parallel columns	Unlimited, 9	N/A ¹	999, unlimited	8, 8	N/A ¹
Uneven column widths available	□	N/A ¹	□	□	N/A ¹
Column widths adjustable by dragging	□	N/A ¹	□	□	N/A ¹
Widow and orphan control	□	□	□	□	□
Can keep paragraphs together	□	□	■	□	□
Maximum point size	255	48	127	127	127
Kerning	□	□	□	■	□
Styles and stylesheets	□	■	■	■	■
Editing features:					
Number of undelete levels	1	1	1	1	1
Search-and-replace	■	■	■	■	■
Drag-and-drop	□	□	■	□	□
Forward and backward	□	■	■	■	■
Case-sensitive	■	■	■	■	■
For non-text characters	■	□	■	■	■
Table feature or editor	■	■	■	■	■
Collapsible outlining	□	□	□	■	□
Automatic indexes and table of contents	□	□	□	■	□

N/A¹—Not applicable: The product does not support this feature.

in a graphics document. In fact, for desktop publishing, it's better to build on a graphics document instead of a word processing document for combining multiple frames such as linked text frames, images, and drawn objects. You can access the same graphics tools from the dedicated graphics module or from within the word processor.

ClarisWorks contains no communications module of its own and instead relies on the Windows Terminal applet, which it accesses from its main menu. You can, however, substitute another filename in the CLARIS.INI file so that ClarisWorks can open a communications package of your choosing.

One of the few integrated programs that's greater than the sum of its parts, ClarisWorks is an excellent choice for any user who values intuitive ease of use over sheer functionality.

► **ClarisWorks for Windows, Version 1.0.** Claris Corp., 5201 Patrick Henry Dr., Box 58168, Santa Clara, CA 95052-8168; 408-727-8227; fax, 408-987-3932.

Circle 496 on reader service card

Footprint Software Inc.

Footprint Works for OS/2

BY STEVE GILLILAND

With Footprint Works for OS/2, Version 1.01 (\$149), Footprint Software provides an entry-level integrated package for OS/2 users, delivering a timely product that takes advantage of its operating system's strengths.

STRONG FOOTHOLD

Footprint consists of three main modules: a word processor, a spreadsheet, and a database with a report writer. A charting module can be opened independently (for manual charting) or accessed via the spreadsheet (for charting based on spreadsheet data).

Command and interface consistency among modules is strong, with nearly identical menu bars throughout. Ribbon bars (analogous to toolbars in Windows applications) provide easy access to shared options such as Boldface, Alignment, and Font. Users can construct macros for use in one module or throughout the program.

► SUMMARY OF FEATURES

CONTINUES



Products listed in alphabetical order ■ = YES □ = NO	ClarisWorks for Windows	Footprint Works for OS/2	Microsoft Works for Windows	PFS:Window- Works	PushButton Works for Windows
Word Processor (continued)					
Footnotes and endnotes	■	□	■	■	□
Proofing and corporate tools:					
Number of words in spell-check dictionary	110,000	116,000	170,000	100,000	130,000
Thesaurus	■	■	■	■	■
Grammar checker	□	□	□	□	□
Mail-merge:					
Supports data-import formats	■	□	■	■	■
Address book	□	□	□	■	□
Data-entry automation	□	■	■	□	□
Printing:					
Defined block/Current page	□ ■	■ ■	□ ■	□ ■	□ ■
Discontinuous range of pages	□	□	□	□	□
Automatic envelope formatting and printing	□	□	■	■	□
File import and export formats:					
Ami Pro	□	■	□	■	■
Word for Windows	■	■	■	■	■
WordPerfect	■	■	■	■	■
Spreadsheet					
Worksheet dimensions (rows x columns x pages)	256 x 16,384 x 65,536	1,024 x 768 x 1	256 x 16,384 x 1	10,000 x 32,000 x 1	1,024 x 768 x 1
Maximum number of open files	Unlimited	Unlimited	8	Unlimited	Unlimited
Worksheet features:					
Named ranges	□	□	■	□	□
Multiple windows	■	■	■	■	■
Hidden columns	□	□	■	□	□
Cell protection	■	■	■	■	■
Spreadsheet merge	□	□	□	□	□
File import and export formats					
ASCII	■	□	■	■	■
.DIF	■	□	□	□	■
.WK1	■	■	■	■	■
XLS	■	■	■	□	■
Spreadsheet functions:					
Total number of spreadsheet functions	100	59	76	46	59
Number of math and analytic functions	64	20	27	25	34
Number of date and time functions	18	13	9	6	13
Number of financial functions	8	5	11	7	5
Number of logic functions	10	7	6	4	7
Can sort by row/column	■ ■	□ □	■ □	■ ■	N/A ¹
2-D/3-D chart types	■ ■	■ □	■ ■	■ □	■ □
Includes print previewer	□	□	■	□	□
Database					
File structure:					
Maximum data-field size (characters)	32,000	32,000	254	128	32,000
Maximum number of fields per record	255	Unlimited	256	128	Unlimited
Maximum number of records per data file	32,000	Unlimited	32,000	32,000	Unlimited
Maximum number of open data files	Unlimited	Unlimited	8	1	Unlimited
Automatic field-name placement	■	□	■	■	■
Supports:					
Automatically generated values	□	■	■	□	■
Indexing	□	■	□	■	■
Validation tests	□	■	□	■	■
Data-field types					
Boolean	■	□	■	■	■
Currency	■	□	■	■	□
Data import and export formats:					
ASCII	■	□	■	■	■
dBASE II, dBASE III, and dBASE IV	■	■	■	■	■

N/A¹—Not applicable. The product does not support this feature.



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- **CPU:** 486DX/33MHz** or i486DX2/66MHz processor
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- **Memory:** 8MB RAM standard, upgradable to 64MB
- **Network Interface Card:** Ethernet or Token-Ring
- **Operating Environment:** IBM DOS with NetWare from IBM V.3.12 or IBM OS/2 LAN Server 3.0, Entry
- **Prices start at \$3,029*** (monitor not included)



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- **CPU:** i486DX2/66MHz processor with 256KB L2 (write-back) cache, upgradable to Intel® Pentium® OverDrive™
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Sample configuration

\$8,359*

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- Ethernet interface card
- IBM DOS and NetWare from IBM V.3.12 — 5 users

ValuePoint Si Clients (3)

- i486SX/25MHz processor
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ValuePoint client configuration options

- **CPU:** i486SX/25MHz to i486DX2/66MHz processor
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- **Memory:** 4MB RAM standard, upgradable to 64MB
- **Monitor:** IBM 14L8 14" Color Monitor (SVGA)
- **Network Interface Card:** Ethernet or Token-Ring
- **LAN Requester:** NetWare from IBM Client, or OS/2 LAN Server Requester
- **Applications:** Choose from popular business software applications available preloaded from IBM Soft Select
- **Prices start at \$1,519*** (prices may vary depending on configuration selected)



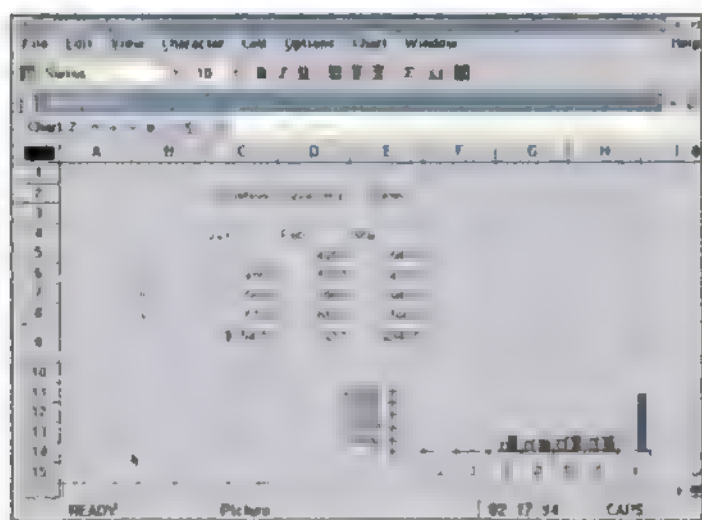
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You can drag and drop to move or copy objects within a window or into other Footprint- or OS/2-application windows. Footprint also supports DDE links among its own modules. You can create dynamically linked data—between the word processor and a spreadsheet range, for instance—with the Paste Link (for text) or Paste Special (for graphically based objects) command. After linking has occurred, data changes in either the source or destination document are reflected in the linked document. Double-clicking on a Paste Special-linked object opens the source application for editing. Still, you can't



You can load Footprint's charting module from within the spreadsheet or on its own.

create a link to or from the database module.

Drawing tools are available in all modules. One tool lets you create a text object and move it anywhere on a document page. Other drawing tools are limited to a series of simple shapes. OS/2, however, takes up some of the slack with PM Chart, an only slightly stripped down version of an excellent tool by Micrografix.

BUGGING OUT

Footprint is potentially easy to use, but on-screen help information suffers from oversimplification, a fault the package shares with OS/2 itself. Also, Footprint has a help-screen bug: When you use the Search option, the cursor sometimes refuses to move to the field where search text is entered, rendering your help search useless. Furthermore, each time you open a new document, a message pops up, telling you that the document has been created for an unsupported printer (regardless of the printer selected). You can't eliminate the message.

SUMMARY OF FEATURES

ENDS

PC MAGAZINE
EDITORS' CHOICE

Products listed in alphabetical order ■ = YES □ = NO	ClarisWorks for Windows	Footprint Works for OS/2	Microsoft Works for Windows	PFS:Window- Works	PushButton Works for Windows
Database (continued)					
.DIF	■	□	□	□	□
Other	.SYLK	.CSV, .TSV	Microsoft Profit	.CSV, PFS:First Choice	.CSV, .DEL, .TSV
Native filing formats:					
dBASE III and dBASE IV	■	□	□	■	■
Proprietary	■	■	■	■	■
Data manipulation:					
Can join data files	□	□	□	■	□
Can index fields	□	■	□	■	■
Maximum number of indexed fields	N/A ¹	Unlimited	N/A ¹	3	Unlimited
Searching:					
By indexed fields	N/A ¹	■	N/A ¹	■	■
By nonindexed fields	■	■	□	■	■
By multiple fields	■	■	■	■	■
By maximum number of fields	255	Unlimited	Unlimited	128	Unlimited
By wildcards or string segments	■	□	■	■	■
Case-sensitive searches	□	□	■	□	□
Sorting:					
In descending order	■	■	■	■	■
On compound fields	■	■	■	□	■
On nonindexed fields	■	■	■	□	■
Maximum number of sorting levels	255	2	3	3	9
Macro or scripting language:					
Can record and play back keystrokes	■	■	■ (via Windows)	■ (via Windows)	■
Charting capability	■	■	□	□	□
Application generator	□	□	□	□	□
Cross-tabular reports	□	□	■	□	■
Update facilities:					
Multiple record and file updates	□	■	□	□	■
Global updates	□	■	□	□	■
Report generation:					
Screen-paint report design	■	■	□	■	■
Generates mailing labels	■	■	■	■	■
Graphics					
Graphics can be built into spreadsheet	■	■	■ (for charting only)	■ (for charting only)	■
Standalone graphics module	■	■	■	■ (for charting only)	■
Graph-export formats	.PCT, .WMF	None	None	None	None
Chart types:					
Area	■	■	■	■	■
Horizontal bar	■	□	□	■	□
Pie	■	■	■	■	■
Text	■	□	□	□	□
Vertical column	■	■	■	■	■
Other	Line; scatter; x, y	Combination, line, scatter, stacked column	Line, radar, 3-D area, 3-D bar	High/low/close, line, point	Line, scatter
Automatic legends	■	■	■	■	■
Combination charts	□	■	■	□	■
Drawing tools	■	■	□	■	■
Graphics manipulation	■	■	□	■	■
Multiple y axes	□	■	■	□	□
Communications					
Built-in communications module	□	□	■	■	□
Automatic dial	N/A ²	N/A ²	■	■	N/A ²
Phone book	N/A ²	N/A ²	■	■	N/A ²
Hayes extended command set	N/A ²	N/A ²	■	■	N/A ²
File-transfer protocols:					
ASCII	N/A ²	N/A ²	■	■	N/A ²
Kermit	N/A ²	N/A ²	■	■	N/A ²
Versions of Xmodem and Ymodem	N/A ²	N/A ²	■	■	N/A ²

N/A¹—Not applicable: The product does not support this feature. N/A²—Not applicable: The communications feature is provided by the operating environment.

During our review process, none of these bugs caused system crashes, but all were irritating. Footprint sources say the problems should be corrected by the time you read this.

THE GOOD WORD—AND THE BAD

Everyday word processing tasks, including all aspects of formatting and printing, are quick and intuitive. A style tool lets you create and save styles easily. Font selection is adequate, and there is a variety of customizable templates. Yet during our review process, the merge-print template would not pick up information from the selected database fields. Instead, we could only use the merge-print option with a newly created form letter. The database prints labels but not envelopes.

The word processor has no column support, but it can integrate graphics in almost two dozen different graphics formats. Words flow automatically around inserted graphics, so it's easy to construct a wide range of document types. There is no provision for automatic indexes, outlining, or table of contents.

SPREADING THE SPECTRUM

The Footprint spreadsheet is functional, though its 59 functions fall short of the 76 in Microsoft Works and 100 in ClarisWorks for Windows. Nonetheless, you can format cells individually—using a style tool that works exactly like the one in the word processor, permitting the formatting of different cell fonts, colors, and shading.

There are some sophisticated spreadsheet features; one, for instance, lets you attach notes to individual cells and automatically create any of eight chart types. These features make omissions like the inability to drag and drop cells or name individual ranges all the more curious.

FLATFOOT

Footprint's flat-file database is one of the stronger modules. Multipage form design

is a simple matter of placing field names on a blank page. Data-entry order is set within a dialog box, as are added touches like color and fill patterns.

Querying is relatively unsophisticated, though Footprint supports unlimited field indexing and multiple field searches. Sort

criteria include Less Than, Greater Than, and Starts With, but queries can't be saved for later use. The database report writer, which is accessible only from within the database, lets you easily create multicolumn reports, which can in-

clude tables and integrated graphics.

OS/2 HELPS

There is no communications module in Footprint, but OS/2 includes fully functional modem software based on a product by Softterm. It has several prewritten

SUITABILITY TO TASK		
Footprint Works for OS/2		
	POWER	EASE
Word processor	Good	Fair
Spreadsheet	Good	Fair
Database	Fair	Fair
Graphics	Poor	Fair
Communications	N/A	N/A
Integration	Fair	Good



It's about time a computer company listened to my needs. Not just tell me what they think I need.

dialing scripts, and it can learn others as you enter keystrokes. Several protocols are supported, including Kermit.

There are some 16 other useful applets in the OS/2 environment, including the aforementioned Micrografx program, a daily planner, a calendar, a to-do list, and alarms—all more fully featured than their equivalents in the Windows environment.

Licensed and marketed by Footprint Software, Footprint was developed by MicroBurst, also PushButton Works for Windows' original equipment manufacturer. But Footprint, thanks mostly to the features in the OS/2 environment, appears to be more strongly integrated than PushButton, even with its first-version problems. As the bugs are shaken out, it will represent a welcome option for OS/2 users. And as its developers ease Footprint into maturity, they're bound to build on the package's own strengths, inside and out.

► **Footprint Works for OS/2, Version 1.01.** Footprint Software Inc., 53 Yonge St., Toronto, Ontario, Canada M5E 1J3; 800-465-8470; fax, 416-860-1780.

Circle 497 on reader service card

Microsoft Corp.

Microsoft Works for Windows

BY STEVE GILLILAND

In the tricky matter of balancing power and cross-module consistency, the \$139 Microsoft Works for Windows, Version 3.0, manages quite well, using OLE 2.0 support and help features such as Wizards to flatten the learning curve and ease integration for all users.

EASE AND INTEGRATION

While Microsoft Works offers a good deal of sophistication, the interface is carefully designed to make the computing neophyte feel comfortable. A selection of Wizards brings step-by-step automation to a dozen traditionally tough tasks. Setting up a mail-merge using the Form Letter Wizard took us only 4 minutes—including the time it took to create the form letter and set up the database. For example, other Wizards are equally facile. The Business Inventory Wizard

creates a database—complete with ClipArt, if desired—for tracking inventory. Another Wizard can help you create a new letterhead using ClipArt or the included Microsoft Draw. With Draw, you can create shapes, arcs, and lines, and then insert them into files created in the word processor or database.

More than 40 modifiable templates are available, and you can create your own. Microsoft's Cue Cards also provide task-specific help for each screen in the program. You can turn them off completely, or minimize them to unobtrusive but at-the-ready icons.

ROBUSTLY POWERFUL

Microsoft Works includes four main modules—word processing, spreadsheet, database, and communications modules. Fully installed, Microsoft Works needs a healthy 14MB of disk space, but omitting Microsoft Draw, ClipArt, WordArt, the spell-checker, the thesaurus, and help reduces its size to a lean 4MB.

On loading Microsoft Works, you see a module-selection screen. You can open an



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Low-Cost Integrated Software

existing document or start a new one in any module. Each module opens on the familiar Windows style screen, with a text menu bar at the top and a toolbar of icons just below. Menu bars for the word processor, spreadsheet, and database are identical, and those for communications are only slightly different. Icons on the toolbar change for each application. Each module can take up a separate window, and a total of eight modules can be open simultaneously.

MAIN MODULES

The word processor resembles Word for Windows, Version 2.0, and offers sophisticated features such as hyphenation, envelope printing, text flow around inserted objects, and easy setup of multiple snaking columns.

Thanks to OLE 2.0, any chart, graph, table, or spreadsheet created in Microsoft

Works can be dragged and dropped into a Microsoft Works module, or into any Windows application supporting OLE 2.0. Double-clicking on any embedded object allows you to edit the object where you've placed it; the double click will open the originating application, but all editing takes place right in the context of the document.

There is a page-layout view that is essential for previewing columns, but no thumbnail page preview. The package offers neither adjustable column widths nor an automated table of contents.

As noted, a Wizard makes merge-printing form letters almost fun, as another does for footnoting. To create a footnote, you choose the Footnote option; a new screen opens. You select from eight footnote types (book, news-

paper, or scholarly journal, for example). The Wizard prompts you for pertinent information such as publication name, author, and date. You choose a footnote style from the on-screen examples, and Microsoft Works creates the footnote for you. The process takes seconds.

The word processor uses a proprietary format, but it can read and write Microsoft Windows Write; Microsoft Word for Windows, Versions 2.0 and 6.0; and WordPerfect 5.x formats.

FORMULA FRENZY

The Microsoft Works spreadsheet module isn't revolutionary, but—like the other Microsoft Works modules—it offers quiet capability enhanced by the ability to quickly transfer data from module to module. You can set fonts and style (including color) for individual cells. An appreciated feature, also present in Microsoft Works' word processing and database modules, puts type size and font control on the toolbar.

There are more than 75 functions, including 27 in the mathematical and sta-

SUITABILITY TO TASK		
Microsoft Works for Windows		
	POWER	EASE
Word processor	Excellent	Excellent
Spreadsheet	Good	Excellent
Database	Good	Excellent
Graphics	Fair	Excellent
Communications	Good	Good
Integration	Excellent	Good

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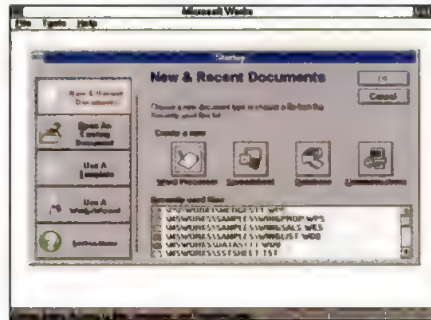
tistical categories. Within those groups are statistical variance and standard deviation functions. Eleven financial tools make quick work of using popular business formulas such as IRR (Internal Rate of Return), DDB (Double Declining Balance) depreciation, and SYD (Sum of the Year's Digits) depreciation. There are half a dozen logical (Boolean) commands, including the conditional IF.

There are almost a dozen different kinds of 2-D and 3-D chart types, all with automatic legend capabilities. Charts need to be saved with the spreadsheet. It's possible, however, to name each chart and treat it as an individual object for inclusion in other documents. Microsoft Works spreadsheets can read and write files from all Microsoft Works versions; Lotus 1-2-3, Version 2.x; and Microsoft Excel, Versions 4.0 and 5.0.

DATABASE: FLAT BUT FUNCTIONAL

The flat-file database in Microsoft Works is simple and usable. A couple of Wizards assist in creating a quick ten-field database or—when the user is working from tem-

plates—an address/phone book. Fields can be arranged by dragging and dropping. Also, they can be aesthetically enhanced by varying field fonts and colors or by adding ClipArt to headings and borders.



Starting Microsoft Works is a matter of choosing the application or template, or asking a Wizard for help.

The relatively sophisticated query tool allows quick creation and saving of as many as three statements per query. You can choose from seven Boolean operators, including AND and OR selection criteria. Database reports are created from another dialog box, allowing for

multiple-field selection and inclusion of any of eight statistical functions. The Microsoft Works database uses a proprietary file format (.WDB) and can read and write dBASE III and dBASE IV files.

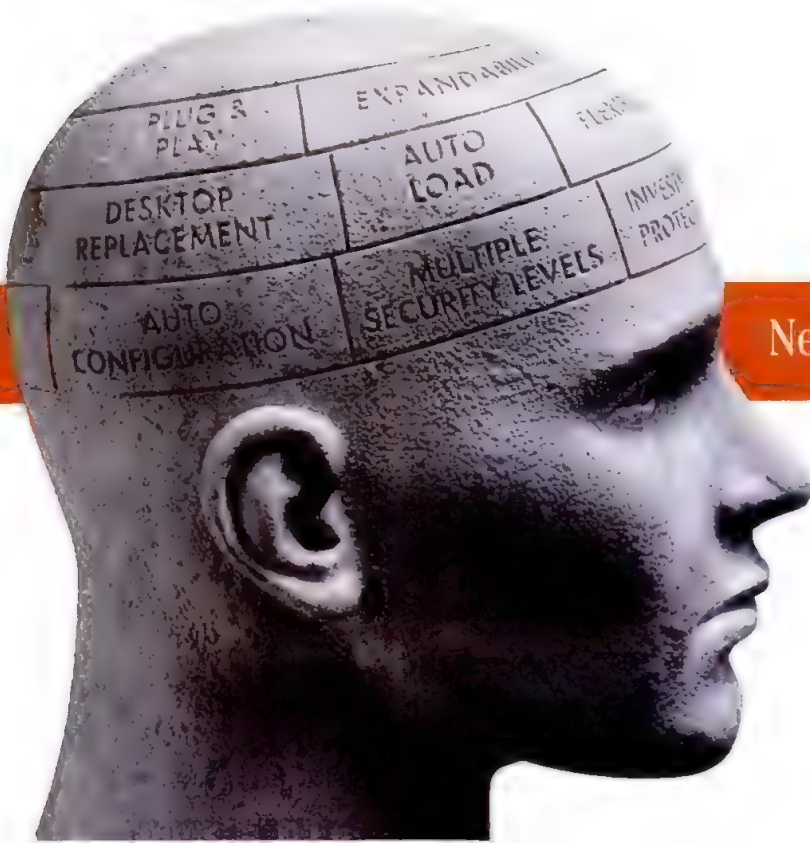
DIAL 'EM UP

Microsoft Works' communications module goes considerably beyond the Windows Terminal applet, doing much to make on-line connections simple. It automatically determines which of four COM ports connects with your modem and uses almost foolproof dialog boxes to set protocols (Kermit, Xmodem, Ymodem, and Zmodem) with baud rates of up to 19,200 bits per second.

Strangely, there are no predefined log-on scripts for public services such as CompuServe or MCI, but a learn mode lets you record log-on or other often-used sequences. Another curious omission is the lack of the CompuServe B protocol.

SUMMING UP

Works is quick, even with multiple documents open, and dragging and dropping



New Intelligent Docking: So smart it



Low-Cost Integrated Software

graphics creates no great delays, even on a 20-MHz 386 notebook.

A fine enhancement would be to provide users of Microsoft Works with price breaks if they decided to move on to any of Microsoft's standalone software packages.

In sum, Microsoft Works bridges the gap between ease-of-use and power, making fewer compromises and providing a richer feature set than any other program reviewed.

EDITORS' CHOICE ► **Microsoft Works for Windows, Version 3.0.** Microsoft Corp., One Microsoft Way, Redmond WA 98052-6399; 800-426-9400, 206-882-8080; fax, 206-936-7329.

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SoftKey International

PFS:WindowWorks

BY KATHLEEN CASTER

In PFS:WindowWorks, Version 2.02 (\$149), SoftKey International combines communications, charting, address book,

and label-making modules with the standard word processor, spreadsheet, and database manager. The company tosses in Delrina Corp.'s WinFax Lite as a bonus. And although WindowWorks' spreadsheet and flat-file database manager are somewhat limited, the package shines in its support for managing contact lists and creating mail-merges.

FIRST THINGS FIRST

Installing WindowWorks takes just a few minutes, and you can customize the process, selecting from a number of options. A full installation (including the fax package) grabs 11MB of disk space; the minimum takes 6MB.

The package's seven modules are displayed as icons at the bottom of the opening screen. You can set WindowWorks to load the modules of your choice when you start the program. You can have any or all modules open at a given time.

WindowWorks also offers a Quick-Button Palette option—a floating toolbar with buttons that change according to the active module. When you're in the word

processor, for example, you get Copy, Cut, Paste, Print, Save As, and Spell Check buttons. It's a nice feature, but some indication of the functions of the various icons—displayed on the status bar or elsewhere—would be a welcome addition.

LINKING AND INTEGRATION

Data sharing among WindowWorks' main modules is easy, especially with the word processor—as you'd expect. When live links are not an issue, users can cut, copy, and paste among modules with speed and ease. For those who want more, WindowWorks supports OLE 1.0; the word processor is a client, and the spreadsheet and database are servers. Linking spreadsheet elements to the word processor is a snap. To edit a spreadsheet table that's embedded in the word processor, you double-click on the table and enter the spreadsheet module; the toolbar changes, and the table is a spreadsheet worksheet once again. Still, the active link between the table and word processor remains. Back in the word processor, you can enter "object mode" with a click of an

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*Color monitor shown above not included with Intelligent Docking System

icon. By clicking once on an embedded table when you're in object mode, you can treat the table as a graphic.

In the database module, the only integration operation that works smoothly is linking data fields to documents for merges. For other database connections, you cannot link. Rather, you must resort to copying and pasting—one field at a time.

Another integration feature, a merge-text option in the word processor, lets you concatenate files onto the active one. There is no DDE support.

WRAPPING WORDS

Beyond the basic editing features you'd expect, WindowWorks' word processor provides styles and style creation, an outliner, and several customizable templates, including business letters, reports, and

newsletters with multiple columns and graphics. You can also define text and graphics frames; text will automatically

flow around them. The word processor offers a drawing tool, and it handles the importation and manipulation of a variety of up-to-date graphics file formats, including .BMP and .PCX. You can't use or place graphics objects in any of the

other modules. The word processor provides no print preview mode, although it does offer several views of your work. Also, the module includes both indexing and table of contents features.

FUNCTION JUNCTION

The spreadsheet's 46 functions encompass mathematical, statistical, financial, date, data-management, and system categories—probably adequate for typical

spreadsheet users, but likely to be too limited for anyone with special needs. Logical functions, for example, are somewhat limited. You can't name ranges, trace cell dependencies or circular references, or attach notes to cells.

To chart spreadsheet data, you simply highlight the appropriate range and click the charting button. The independent charting module pops up, and you then drag the mouse to create a frame for the chart. Charts appear only in black and white, but you can manipulate text and add titles and legends easily. If you change your numbers, the chart reflects those changes immediately. And the chart and sheet remain linked, even when inserted into the word processor as OLE objects. The charting module also supports manual charting.

FOR THE RECORD

Adding records to WindowWorks' flat-file database manager is easy; equally easy is placing field labels in text documents for simple mail-merges. The module has QBE (query by example) support, but you can't save your queries. You can

SUITABILITY TO TASK		
PFS:WindowWorks		
	POWER	EASE
Word processor	Good	Good
Spreadsheet	Good	Fair
Database	Fair	Good
Graphics	N/A	N/A
Communications	Fair	Fair
Integration	Good	Good



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view data record by record, in the card-file format or in tabular form. Tables are easily printed, but other reports are more of a challenge: You can sort tables on three different keys, in ascending or descending order, but laying out reports requires time and effort.

Address book and label maker modules organize contact information and link it to other modules. You can use address book listings for mail-merges, but unfortunately, you can't import other database files into the address book because it is limited to

WindowWorks' proprietary format. When your document mail-merge is done, preparing your envelopes in the label-making module involves just a few simple steps.

The communications module looks like a slightly glorified Windows Terminal

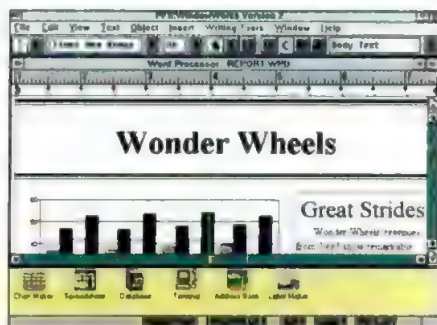
with a toolbar. It comes with two customizable log-on scripts; you can also create your own. The scripts are dialog boxes that let you specify phone number and user ID, as well as baud rate. Also, there is no list for choosing specific modems.

WindowWorks delivers some solid functionality—more so in the word processing and contact management modules than in spreadsheets and database management—for a price that's merely middle-of-the-road. Users who enjoy a document-centric work environment will be able to turn this package into a viable productivity tool.

► **PFS:WindowWorks, Version 2.02.**

SoftKey International, 201 Broadway, Cambridge, MA 02139; 800-323-8088, 617-494-1200; fax, 617-494-1219.

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In PFS:WindowWorks, you can easily combine text and graphics in reports and newsletters.

PushButton Software Inc.

PushButton Works for Windows

BY GREGG KEIZER

Though its title may make you think of George Jetson's one-task job, PushButton Software's PushButton Works for Windows, Version 3.0, doesn't let you kick back your chair and put your feet up on your desk. The package, though capable of tackling basic everyday tasks, lacks the stylish integration of a ClarisWorks for Windows and the power of a Microsoft Works for Windows. Yet with its bargain price of \$49—less than half the price of either of those competitors—PushButton is a good choice for integrators on a budget.

HARD WORKS

PushButton's word processor, spreadsheet, and database modules—joined by its charting and database reporting tools—provide the basics of integration. You can insert charts created from spreadsheet data, generate a series of form letters from

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a database, and link numbers in a spreadsheet with tables in a word processor document. But unlike ClarisWorks, PushButton can't build sophisticated compound documents with multiple columns and custom-created graphics. Still, consistency among toolbars and icons is strong.

PushButton lacks a communications module, without even providing a built-in link to the Windows Terminal applet, as some of the other packages in this roundup do. Also, it offers only a bare-bones set of object drawing tools.

Moreover, its Windows system-resource appetite is monstrous; it can easily consume 30 to 40 percent of such resources. With just one other application active, you may find yourself unable to open more than three or four windows in PushButton.

PushButton lacks many ease-of-use

amenities. It does not have an on-line tutorial, for example, and its help is only vaguely context-sensitive. That is, it is only sensitive to what module—not, say, what dialog box—you're in. Furthermore, it asks you to jump through hoops to complete some of the most common tasks. For example, if

you want to paste accurately, you must copy data from a spreadsheet *before* building a table in the word processor. Still, the package is petite; maximum installation takes up 6MB. Installed without templates and clip art, PushButton

takes up 4MB and performs acceptably on a Windows notebook.

EASY WORDS, AWKWARD MAIL-MERGE

As a straightforward writing tool, PushButton's word processor can handle most chores. It also includes 15 templates.

Writing, formatting, and printing simple documents such as reports, letters, and memos is a snap. You can easily build tables and insert graphics—around which text can wrap in four different fashions. Moreover, the process of creating and using a variety of custom text styles (one for headlines, another for subheads, for instance) is quick and simple.

The word processor has its limits, however. It doesn't offer an outline function, nor does it provide for envelope printing. Also, it's limited to one-column formats, so newsletters are out of the question for all practical purposes. More important, its implementation of mail-merge is a bit awkward. Building a merge document is simply a matter of inserting field names from the appropriate database, but printing just a portion of that database is tougher. You cannot query the database and then merge the results; you must instead conduct the query from within the word processor. This blind searching can be frustrating.

You can import graphics into a document from a wealth of formats. But the

SUITABILITY TO TASK

PushButton Works for Windows

	POWER	EASE
Word processor	Fair	Fair
Spreadsheet	Fair	Fair
Database	Fair	Fair
Graphics	Poor	Fair
Communications	N/A	N/A
Integration	Fair	Fair

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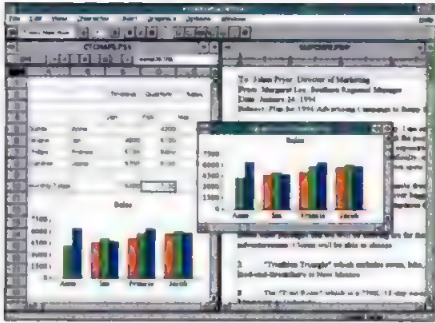
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package supports only Word for Windows 1.0 and WordPerfect 5.x for DOS text formats.

NUMBERS TO CHARTS

PushButton's spreadsheet is more robust than its word processor. Formatting control ranges from good to excellent. The



PushButton's tools can easily deal with the basics, such as building a simple document that includes charts and tables culled from spreadsheet data.

spreadsheet lets you set an individual cell's style and font and even apply styles that you've previously created and saved, but it doesn't include advanced features like moving columns or rows or combining nonconsecutive cells within a formula.

The function list is on the light side—there are fewer than 60—but the toolbar places several operations just a click away. You can split the screen and even attach notes to specific cells. You cannot, however, combine nonconsecutive cells within a formula or move cells, columns, or rows by dragging and dropping.

Chart creation, though, is slick—as long as you do it by selecting cells and clicking on the chart icon. Eight 2-D chart styles are available. You have to double-click on the chart (entering the chart tool in the process) to add such extras as legends and titles. As in all of PushButton, help is hard to come by when you're revising a chart.

ON YOUR OWN

PushButton's database module is a flat-file database, able to hold everything from phone contacts to an inventory listing. It includes four modifiable templates, one of which is a contact database. The database is a capable tool that needs some ease-of-use enhancements, such as a snap-to grid for instant field and label alignment.

You design a form by entering field

names and placing them on a blank screen. You can set the order of data entry by modifying a list within a dialog box. With a bit of work, you can shade and color sections of the form for greater emphasis. Field types include date, number, text, and picture.

Selecting specific records within the database takes more concentration, for the dialog box is far from intuitive. It does offer such criteria as Greater Than, Greater Than or Equal To, Contains, and Starts With, but you can't save your selections for later recall. You can, however, create and save sorting indexes.

Building a database report within PushButton is somewhat easier; you select field names, then arrange the resulting columns by either changing a list or manually dragging and dropping them on the screen. One serious oversight, however, is the lack of report templates, so you're on your own.

THAT'S ALL, FOLKS

Although PushButton claims that its graphics and database reporting modules are separate modules, the latter is techni-

cally part of the database. The graphics module is mainly for charting, but it does include drawing tools, which are also available for use in the word processor and database modules. The macro facility, available in the three main modules, is a nice addition; it's easy to use and lets you run macros either within the native module only or across modules.

A year or so ago, PushButton would have competed with the best integrated packages. Today, though, it's neither as feature-packed and easy to use as Microsoft Works nor as tightly integrated as ClarisWorks. Still, it provides basic Windows tools for dealing with words, numbers, and data, particularly for those pinching every penny.

Although PushButton isn't nearly as push-button as its name implies, it works, and among members of its price class, it's a standout. □

► **PushButton Works for Windows, Version 3.0.** PushButton Software Inc., 1700 W. Park Dr., Westboro, MA 01581; 800-277-7874; fax, 508-366-8010.

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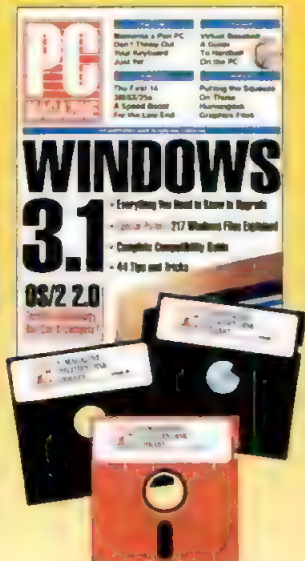
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VIDEO-CAPTURE & EDITING TOOLS



Reel *to* Real

Video on the PC sounds great. You capture it, edit it, and voilá, it's MTV, right? Not exactly. The technology's still developing, but today's tools can help you spice up your next presentation.

By Jan Ozer

Your boss has just handed you a videotape. "Here," she says. "These are testimonials filmed at the users' meeting. Pick the best clips and get them on the new laptops we just bought for the sales team."

As she leaves your office the words "postage-stamp video" come quickly to mind. You start humming the theme to *Mission Impossible*, and wonder if maybe it's time to update your resume.

Relax. Your career is not about to self-destruct. Postage-stamp video is last year's story—this year there are more tools available, and you can do better. In these pages, we look at the tools you'll need (video-capture boards, video-editing software, and compression technology) to create your first video-enhanced presentation. We review seven video-capture cards priced under \$700 and five video-editing programs priced under \$500. Your results won't challenge professional-quality video, but you'll impress the sales folks, delight the board of directors, and look like a genius for buying those expensive laptops.

We start with two assumptions: first, that you're working in the Windows environment, and second, that you're not making an

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investment in additional hardware for playback on your office machines, which limits our focus to software-only compression technologies.

Nevertheless, to understand video on the PC today, it's important to know the history, and a little bit about the state of state-of-the-art video technology.

PERFORMANCE ANXIETY

Like many new technologies, digital video has a somewhat checkered past: products released before their time, CPU-hungry technologies running on under-powered machines, and jerky, fuzzy, postage-stamp video touted as the second coming of the GUI. But video on the PC has a unique Achilles' heel best typified by the question "Why does video look better on my \$200 TV?" Well, it's simple: Video is analog; computers are digital.

Computers can't handle analog information directly—they have to simulate it. Computers start by digitizing the video, or by dividing the analog frame into individual picture elements (pixels). A 640-by-480 frame requires 307,200 pixels, each of which takes one byte to store. Add the 24-bit color depth necessary for high-quality video and you've tripled the storage requirement to 921,600 bytes per frame. At 30 frames per second, you're up to 9.2 million pixels and over 27 MB of data—each second! This not only presents tremendous storage and bandwidth problems, it's more data than even the most powerful desktop computer can handle in real time.

A number of simple "scaling" techniques are used to reduce the load. The

first is to shrink the image size. Quarter-screen video (320-by-240) requires one quarter the bandwidth of full-screen video (640-by-480), which brings you down to 6.912 megabytes per second. The second is to cut the frame rate, which is the number of frames displayed per second. Most video is acquired at 30 frames per second (fps), the same rate as television. Dropping from 30 to 15 fps cuts your data rate in half, to about 3.5MB per second. The third technique is to reduce the color depth. Dropping from 24-bit to 8-bit reduces the data rate by another two thirds, taking you down to just over 1.1MB per second. Depending on the type of video, you'll know which approach to take.

Unfortunately, even a data rate of 1.1MB per second is still too high for even quadruple-speed CD-ROM drives and most non-SCSI hard disks. So scaling the image size, frame rate, and color depth still doesn't get the job done. That's where video compression comes in.

VIDEO SQUEEZE

Video compression is a collection of techniques used to shrink video files. Embodied by products called codecs (compression/decompression), these methods fall into two general categories: *interframe* and *intraframe* compression.

Interframe compression uses a system of *key* and *delta* frames to eliminate

redundant information between frames. Key frames store an entire frame, while delta, or "difference," frames record only the interframe changes. During decompression, the CPU builds frames from the key frames and accumulated deltas.

Intraframe compression is performed entirely within individual frames. During intraframe compression, codecs use a variety of techniques to convert pixels to more compact mathematical formulas. The simplest technique is called run length encoding (RLE), in which rows of adjacent identical pixels are grouped together.

Intraframe technologies range from simple RLE to documented standards such as JPEG to exotic mathematical disciplines such as wavelets and fractal transform. Not all codecs use both interframe and intraframe techniques—some use only intraframe. Those that use both apply intraframe compression on key frames and the information remaining in delta frames after removing interframe redundancies.

All video sequences have differing amounts of interframe and intraframe redundancy, which means that different sequences will compress with various degrees of success. Today's codecs can generally guarantee that you'll reduce your data rate to a somewhat more reasonable level. The question is, at what price?

LUNCH MONEY REQUIRED

The saying "there's no such thing as a free lunch" holds true for codecs. The price of a codec's reduction in data rate is diminished video quality.

All relevant codecs are "lossy" in nature. During compression, pixels are replaced with more compact formulas designed to approximate the original detail rather than recreate it exactly. As you would expect, the greater the compression, the greater the loss of video quality.

Compression aside, there are the formidable operational aspects of video to

The price of a codec's reduced data rate is poorer video quality. All relevant codecs are "lossy" in nature.

Our Contributors: JOHN R. QUAIN and LUISA SIMONE are contributing editors of *PC Magazine*. JAN OZER is president of Doceo Publishing, a multimedia publishing company. LANCE ULANOFF was the associate editor in charge of this story, and JEFF MACE was the project leader.

Video's Route Through the PC

A **standard video source**, such as a camcorder, VCR, or laserdisk player, transmits the analog video signal to the video-capture board, while analog audio is sent to a sound board inside the PC.

The **capture board** utilizes analog-to-digital converters (ADCs) to transform the analog video signal into binary code. The video footage can be captured as a raw sequence of video frames, which is sent to and held in system RAM where software compression is performed.

Meanwhile, the **audio signal** undergoes analog-to-digital conversion by the sound board's converters. This information is also sent to the PC's main system RAM.

After the **video and sound** tracks have been captured, the captured signal can be stored directly to the hard disk or software-based compression can be applied. Generally, the digital video and audio signals are stored as a synchronized, or *interleaved*, .AVI file on the hard disk.

Because the video-capture boards in this roundup do not provide **hardware-based decompression support**, the CPU was responsi-

consider. Video I/O and decompression take lots of CPU cycles. Local-bus architectures ease the load by speeding data transfer. And with clock-doubled 486 and Pentium processors, we finally have systems up to the task. The result? A local-bus 486/66 system equipped with a fast hard disk should play 320-by-240 video in 24-bit color mode at 15 fps.

Postage-stamp video is dead. Long live quarter-screen video.

MICROSOFT'S SOLUTION

Before Microsoft Video for Windows (VFW), the video market was composed of separate, incompatible products. Codecs used proprietary file formats and APIs that complicated video creation and integration. Video-capture boards were codec-specific, which was fine for Intel and IBM but was a problem for small codec vendors without the expertise or financing to build their own hardware.

Overall, market growth of multimedia for the PC was retarded by the lack of

standards that were in full bloom on the Macintosh platform with Apple's QuickTime standard. This was the problem Microsoft sought to address with VFW, which was introduced in November 1992.

VFW is both architecture and application suite. As an architecture, VFW provides both inbound and outbound APIs. The inbound APIs include the audio/video interleave (AVI) file specification. By defining a standard format, Microsoft opened the market for third-party hardware developers to build compatible capture boards. Codec developers could access these capture devices through I/O support for the .AVI format. Finally, Microsoft opened a market for other video peripherals, such as video-editing software, by ensuring a critical mass of video developers using a standard format.

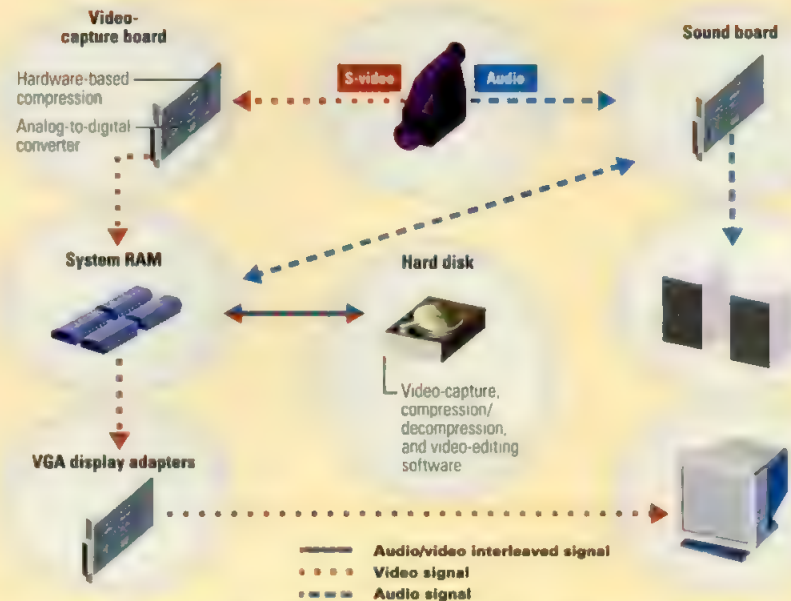
VFW provided two outbound APIs enabling the integration of video into other applications. The lowest-level API is a set of extensions to the Media Control Interface (MCI) released by Microsoft in

1991, which is designed to communicate with multimedia devices. MCI commands are similar to BASIC routines and are designed for use by programmers. Video can also be linked or embedded through Media Player, a Windows application and OLE server.

On the applications side, VFW includes VidCap, a video-capture program, and VidEdit, which provides rudimentary editing functions and control over the growing suite of VFW codecs. The first VFW release included two codecs, Video 1 and RLE.

During 1993, Video for Windows was widely criticized for selling only 50,000 copies, mostly bundled with video-capture boards. But consider this: Had we reviewed Windows-based video-capture boards that cost under \$700 a year ago, we would have had—well—no boards to review. This year we received over 20 boards, 7 of which met our testing criteria. Similarly, a list of Windows-based video editors at any price would have been equally short; this year we have 5.

Video Capture and Editing



ble for decompressing the files in system memory. The decompressed digital video portion of the .AVI file is sent from memory to a conventional

VGA or SVGA graphics adapter, where it is converted into a noninterlaced analog signal.

—John R. Quain

HIGHLIGHTS

Video-Capture & Editing Tools

A CROWDED FIELD of video-capture boards for the PC (all under \$700) quickly dwindled down to seven under the rigors of PC Labs testing. And none that met our review criteria could capture raw 24-bit video without hardware-based compression assistance.

THE INTEL Smart Video Recorder and Media Vision's Pro MovieStudio proved relatively easy to install and captured video with a nice balance of color integrity and fluid motion. Most boards, however, do ask users to sacrifice color for motion or vice versa.

WITH THE RIGHT HARDWARE (including a very powerful 486 system, a zippy hard disk, and a mountain of RAM) and a little

patience, you can capture short, full-motion video clips to insert into your next presentation.

UNDERSTANDING CODECS (compression/decompression schemes) and knowing which one is right for your needs is one of the first steps in creating video clips for the PC. Another consideration is whether you'll be creating the clips or viewing them.

NO VIDEO-EDITING software product has every tool for every need. But each shines in one way or another. Most provide basic tools for creating familiar video effects such as wipes and Chroma-Keys. And others, such as Adobe Premiere for Windows, offer exotic filters for greater creativity.

Included in Video for Windows, Version 1.1, released last December, are two high-performance codecs—Intel's Indeo and Cinepak, both of which provide a much-needed 25 to 50 percent performance boost, enhanced Macintosh compatibility, and audio compression. More important, however, are clear signals that Microsoft intends to narrow its focus to video architecture as opposed to products.

The new version of VFW contains comprehensive capture and compression APIs that enable continued third-party development of these functions. Microsoft has stated that it will cease further development of VidCap and VidEdit and is offering VFW 1.1 only as a developer's kit, not as a retail product. Microsoft also announced that it will merge VFW into Chicago, the company's 32-bit Windows release due this year, and into Windows NT.

GETTING STARTED

Now you know the level of performance to expect and the environment you'll be working in. Your next task is to select the clips that will capture and compress most effectively.

Since interframe compression relies on redundant data between frames, high-

motion sequences obviously won't compress as effectively as a "talking head" newscaster would. Less obvious are subtle camera techniques such as panning or zooming. Such slow camera movement causes nearly every pixel to change every frame—pretty hostile for interframe compression. Ditto for those candid handheld shots—when you shoot without a tripod, interframe motion is almost unavoidable.

Your best bet is to pick sequences with clean foreground and background patterns. All video has *noise*, or distortion, which is increased during capture. This can transform a striped shirt into a blotchy solid and a complex wallpaper pattern into a boiling mass of colors and motion.

Capture is where analog signal is digitized into individual pixels. The process requires a video-capture board and usually a sound board. During capture, an analog source feeds the video signal into the capture board, which digitizes the video frame by frame, while audio is captured simultaneously (for more information, see the sidebar "Video's Route Through the PC"). VFW controls the entire process, including sound synchronization, either through VidCap or a proprietary VFW application supplied by the video-

capture board vendor.

Your goal is to digitize every frame at the highest possible quality. However, real-time capture is extremely demanding, and frames are often dropped, especially when capturing in 24-bit format. When a frame is dropped, the proceeding frame is duplicated to maintain the proper frame count and audio synchronization.

To reduce the load on the computer and improve capture performance, capture boards offer different capture formats. Some boards capture and compress simultaneously, which reduces the captured video stream by over 90 percent. However, the compression is "lossy," which detracts from

capture quality. To edit the video, you'll have to decompress and then recompress—the codec equivalent of photocopying a photocopy. And real-time compression typically doesn't compress the video sufficiently for final use—so you may have to recompress.

Another approach is to capture in YUV format, a "video-friendly" color-reduction scheme that reduces the size of the video stream by between 30 and 60 percent. This improves the capture yield without detracting from video quality, but often at the cost of a few dropped frames. Alternatively, you can capture in 8- or 16-bit modes, which reduces the incoming video stream at some cost to overall color quality.

YUV is probably the optimal capture format. You can improve the capture yield by capturing longer clips in several short bursts and combining the files after capture. While this can be a pain, the process often pays for itself in video quality. Otherwise, capture in compressed format at the highest quality possible, and optimize the number of frames captured.

Editing is the next step. At this stage, you crop the video to the proper length, combine videos, insert transitions, add titling and other effects, and generally get

Video-Capture & Editing Tools

the videos ready for prime time.

The final step in the process is compression. Here's an overview of the codecs available today:

Cinepak—The best codec for action sequences, and typically the fastest at 16-bit and 24-bit playback. Comparative quality slips for talking-head and other low-motion sequences. Takes forever to compress.

Indeo—Produces highest-quality talking-head sequences at very low data rates. Slow in 16-bit-mode playback. A bad choice for action sequences. Slightly faster than Cinepak at compression, but

still a real tortoise.

Video 1—Either Indeo or Cinepak is better than Video 1 at video capture except in situations when you need palletized talking-head videos.

RLE—Not optimized for real video. Use only for animated sequences.

There you have it—from analog to AVI. The rules are complicated and there's still lots of trial and error. But there can be no denying the impact of video, or that it's gaining momentum in the corporate market.

So good luck, or should we say, "Break a leg"?

to look choppy. To tax the abilities of these products, PC Labs pushed each board to larger window sizes at 30 fps. None of the cards was able to capture true, full-motion video in a window bigger than 160 by 120 pixels without hardware-based compression, and one card, the ColorSnap PC PRO, was unable even to manage that.

There are two exceptions to these results—the only two boards to include built-in hardware-based compression support: the Intel Smart Video Recorder, which uses Indeo 3 compression, and Media Vision's Pro MovieStudio, which relies on Video 1. Intel's entry did not skip any frames in our tests until it was pushed to 30 fps in a 320- by 240-pixel window size. Unfortunately, the Smart Video Recorder does not record video in a 24-bit RGB (red, green, blue) mode, and as a result sacrifices some color vividness in the process. Media Vision's entry, on the other hand, managed to get all the frames in a 30-fps clip at 320 by 240 pixels using its Video 1 compression mode. However, it sacrifices some color accuracy (Video 1 is only 16-bit color) as well as image sharpness in the process.

WHAT TO LOOK FOR

Many video-capture boards will let you improve the capture rate and thus obtain better motion video by reducing the amount of color. In an 8-bit palletized mode, for example, most of the cards will capture 10 to 30 percent more frames. Unfortunately, the resulting clips look like a psychedelic MTV video. On the other hand, using a lossy compression codec such as Indeo or Cinepak still means you lose either color or image

detail, or a little of both.

So if you want to edit video captures and create special effects with care, look for a video-capture board that does a good job of capturing uncompressed video in 24-bit RGB mode. This will give you the best frame-by-frame source material to work with, and it will turn out higher-quality,

Video-Capture Boards

BY JOHN R. QUAIN

After working with nearly 20 video-capture boards and finding 7 that were ready to be tested for this roundup, *PC Magazine* can tell you the truth: When it comes to capturing and working with digitized video on a PC, the hardware is still the weak link. The digitized clips often look like a re-run of *Max Headroom*, the picture isn't full-screen, and installing a video-capture board on your computer makes setting up a LAN look like child's play.

Now that you know the bad news, the good news is that putting short video clips into multimedia presentations, adding them to corporate newsletters on a network, or capturing video clips for training applications can be done for a reasonable price and, in most cases, with much less fuss than ever before. The video-capture boards in this review have street prices that range from just over \$200 to \$600, accept standard video sources such as VHS VCRs or Hi-8 camcorders, and can capture and compress acceptable motion video in a 320- by 240-pixel window.

THE CONTENDERS

Although the video-capture boards available through direct marketers and retailers range from dedicated \$20,000 professional capture systems to \$200 VGA adapters that accept broadcast video signals, *PC Magazine* focused on products squarely aimed at Windows business users looking to add video clips to their

work. The seven ISA video-capture cards that made it into this review—Computer Friends' ColorSnap PC PRO, Creative Labs' VideoSpigot for Windows, the Intel Smart Video Recorder, Jovian Logic Corp.'s QuickVia, Media Vision's Pro MovieStudio, Sigma Designs' WinMovie, and VideoLogic's Captivator—can all accommodate an S-video source, capture full-motion 30-frame-per-second (fps) video as a Windows AVI (audio/video interleave) file, have a list price of \$700 or less, and were shipping to customers at the time of this roundup.

In order to assess the quality of these products, each board captured a 10-second video clip from a Sony Hi-8 video tape recorder (VTR) in a variety of window sizes, color depths, and formats. The test clip of a motorcross race contained plenty of color and motion, which let us fully assess the boards' abilities to render full-motion video faithfully.

All of the tested boards are able to capture 24-bit color video in a 160- by 120-pixel window using a 15-fps setting. However, this size is relatively small and the frame rate is half that of broadcast television's 30-fps rate, so the results tend

When considering the purchase of a video-capture card, don't forget to take into account all the additional equipment you will need.

Choosing a True Color Accelerator

It is no longer necessary to give up performance or high resolution to have rich photographic colors. Some valuable information to help you select a true color accelerator follows:

Performance = 64+24

True color (referred to as 24-bit, or 16.7M colors) requires a graphics board to process three to four times more information than it would for 256 colors. Fast 64-bit graphics chips with complete hardware-assist functions for 24-bit acceleration are best suited for fast true color use. Some accelerators offer only 32-bit graphics engines or limited 24-bit color drawing functions. When comparing graphics performance, be sure to ask your vendor for results in true color mode, not just in 256-color mode.

Don't Reboot Windows

Conventional 2MB graphics cards force you to choose between high resolution graphics at 1280x1024 with only 256 colors or true color with only 800x600 resolution. Since you can't have high resolution mode for detailed text work and true color mode for rich photographic colors at the same time, you have to compromise.

To switch modes, conventional boards require you to leave the application and then restart Windows. This process is inconvenient and time consuming. Look for features like ATI's WinSwitch, which allows you to quickly and conveniently toggle between high resolution mode and true color mode using a simple keystroke without closing your applications or leaving Windows.

VRAM Really Matters

Only VRAM memory guarantees stable performance in true color modes because of their dual port design. Most DRAM accelerators may look fast in 256-color mode, but will offer only a fraction of the performance of VRAM accelerators in true color mode. Avoid DRAM memory for serious true color work.

Watch for new helpful information.....

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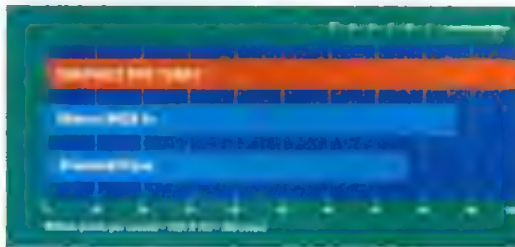
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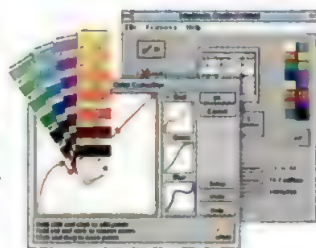
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PCBench 7.01	25.7	12.1	4.6
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Color Depth	24	11	13

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* All performance tests done on a Pentium 66MHz, 16MB RAM, 256K cache, 200MB HD at 60Hz, using 2MB versions of PCI graphics cards. † WinBench 3.11 at 1024x768 resolution in 256 colors
†† VGA performance tested using PCBench 7.01 (video harmonic) ††† Motion Video performance measured under Windows using 65K colors. Test clip recorded at 320x240 at 30 fps using Indeo codec.

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EDITORS' CHOICE

- **Intel Smart Video Recorder**
- **Pro MovieStudio**

ity compressed files after you've finished editing. It does, however, mean sacrificing motion and dropping more frames unless you stick to a smaller 160-by-120 window.

If you insist on near-full-motion in a larger window, a good compromise is to select a capture board that will record clips in the YUV digital format. The format provides images that are sharper than compressed video images, captures more frames than straight RGB, and results in a minimal loss of color. YUV separately samples the brightness, or *luminance*, portion of the video signal (represented by the "Y") and the two color coordinates (represented by the "U" and "V") of the signal. A YUV 4:1:1 ratio uses 4 bits to sample the luminance and 1 bit each to sample the color portions of the signal. Hence, YUV 4:2:2 will render even better color accuracy.

SOFTWARE DIFFERENCES

Further points of diversion among the video-capture boards in this roundup reflect differences in the software controls they provide. Several of the cards, for example, do not display the video source while you're recording, so you have to guess when to stop a capture or use a standard television monitor in addition to the computer monitor. Furthermore, the video image can sometimes be misaligned in the display window, or a poor video source tape may look underdeveloped when you see it on your computer screen.

Several boards add proprietary video-capture utilities to Microsoft Video for Windows software to correct these problems. The Jovian and Sigma cards, for example, allow you to adjust the vertical and horizontal positioning as well as brightness and color-saturation levels. Media Vision's Pro MovieStudio goes several steps further by including anti-gamma controls (for color brightness), a sharpness filter, and an automatic chroma (color) gain control. However, don't expect all the software you'll need to come with the board (for more information, see "Video-Editing Software").

WHAT ELSE YOU NEED

When considering a video-capture card purchase, don't forget to take into ac-

First the facts: If you want to capture live video with an audio track at 320-by-240 resolution, you'd better have at least a 486 DX2/66 system with lots of RAM and a fast hard disk, and use a video capture board that has hardware-assisted compression. That being

said, two boards we reviewed did stand above the rest. The Intel Smart Video Recorder and Media Vision's Pro MovieStudio both earn Editors' Choice awards. They are the only two boards we looked at that feature hardware-based compression support (others did feature YUV color reduction).

The Intel board's easy installation and strong, full-motion capture abilities make it a standout product. Its Indeo compression mode produced the best image quality in our capture tests at 320-by-240 resolution and 30 fps. In addition, the Smart Video Recorder comes with some of the best documentation and software of any board we looked at. Of course, not even this board could give us something for nothing. Smooth playback means that some color quality is lost.

Media Vision obviously put a lot of thought into Pro MovieStudio. In addition to smooth, 16-bit video capture, the board maintained color depth and qual-

ity in all modes. Like other boards we tested, though, its frame-capture rate was reduced in 24-bit, 30-fps mode.

Nonetheless, Pro MovieStudio was one of the easiest boards to install, with all address and IRQ settings selected via software. It also had a few nice extras such as tools for controlling components of the analog signal.

Though we did not select an Editors' Choice for video-editing software, we recommend ATI Media-Merge if you're new to video on the PC. The package features a module that works very much like the slide sorters found in presentation products. Those with a more creative flair may appreciate Adobe Premiere for Windows, Version 1.1, which offers users image-editing filters and 35 customizable transition effects. Splice!, Version 2.0, may be one of the most well-rounded products, while also offering the best video motion-control capabilities of the bunch.

count all of the additional equipment you'll need. Since none of the video-capture cards here include audio support, a VGA adapter, or hardware playback assistance, you may have to add other components to your PC.

A Windows-compatible sound card that's able to record 16-bit, 44.1-kHz stereo audio for under \$200 is a necessity. Make sure it offers enough input jacks to accommodate your video source and a separate microphone so that you don't have to keep switching inputs. You'll also need a reasonable pair of magnetically shielded self-powered speakers (ranging from \$70 to \$400).

A word of warning here: Getting a video-capture card to work in conjunction

with a sound board is not an easy task. If you're lucky, the default settings will work the first time you try out the board. But more often than not, you'll have to spend some time negotiating between battling IRQs and memory addresses.

Ironically, even though you may be able to capture 30-fps video, this doesn't necessarily mean you'll be able to play it back on your PC. For the best playback results, make sure you have a Windows graphics accelerator—preferably one that supports stretch block transfers (BLTs).

Finally, you'll need some old-fashioned analog video gear and the necessary cables to feed the video source into your desktop video system. A garden-variety VHS VCR will do the trick, but it delivers

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Benchmark Tests: Video-Capture Boards

What the Numbers Mean

PC Labs tested seven video-capture boards to determine their ability to capture analog video from a VTR (videotape recorder) via an S-video line.

The chart below, at right, illustrates how, without the benefit of any hardware-assisted color-reduction or compression scheme, each board performed poorly when capturing raw video data at both 30 and 15 frames per second (fps) at 320-by-240 resolution. The 24-bit raw captures yielded the best results of any available capture mode in terms of color quality and picture clarity, but the percentage of dropped frames resulted in unusable video clips from all the boards. The Intel Smart Video Recorder, which could not capture 24-bit raw video, received an N/A for this test. PC Labs determined that system throughput was the bottleneck in capturing 24-bit video because the majority of the dropped frames occurred after the boards' I/O buffers ran out of RAM and began writing to the hard disk.

The chart below, at left, which illustrates the results of video captured with a hardware-assisted color-reduction or compression scheme (if available), paints a completely different picture. Hardware assistance came in two flavors: through a proprietary compression implementation or through YUV which in addition to compression on some boards, employs a color-reduction scheme. The boards that offered hardware assistance captured video clips at 320-by-240 resolution without dropping frames. VideoSpigot for Windows dropped 20 of 150 possible frames in its Spigot Compression mode, but didn't drop any frames in its YUV mode. WinMovie used "Video 8" 8-bit palletized, non-hardware capture that dropped only 14 of 150 frames, but it also produced poor color quality.

In terms of color quality, however, we found little similarity in the performance of these boards.

The frame samples at right are from the final Cinepak files we created using each board's most successful frame-capture mode. We used Cinepak because it is a neutral codec that is not directly supported by any of the boards. The Intel Smart Video Recorder consistently maintained picture clarity but sacrificed color tonality. Pro MovieStudio preserved the best color but lost clarity on some frames because of its lossy compression at the capture level. The boards from Jovian Logic Corp. and Sigma Designs used similar 8-bit schemes and provided poor color quality.

How We Tested

PC Labs designed a test-bed that included Micron 486 computers configured with Micronics EISA/VESA local-bus motherboards with a 256K L2 cache and 16MB of RAM. We installed Seagate ST3655A HDD IDE hard disks, which feature a 528MB formatted capacity and a 256K cache buffer, providing a 12-ms average seek time. We installed Media Vision Fusion DoubleCD 16 Kits with double-speed CD-ROM drives, Pro Audio Spectrum 16 sound cards, and Labtech CS-550 amplified speakers as the multimedia hardware. We used Matrox MGA Impression graphics cards with 3MB of VRAM running at 800-



These frames, taken from each board's final production file, illustrate the differences in color quality and image clarity among the tested boards.

by-600 resolution with 24-bit color for all our tests. PC Labs produced a test video, including an audio track, mastered down from Betacam to Hi-8 format. We burned the striped time code into each frame so that we could accurately count the number of frames we captured. We used VCS from Doceo Publishing (a program that analyzes digitized video) to help us analyze and compare the captured video clips. —Analysis written by Jeff Mace

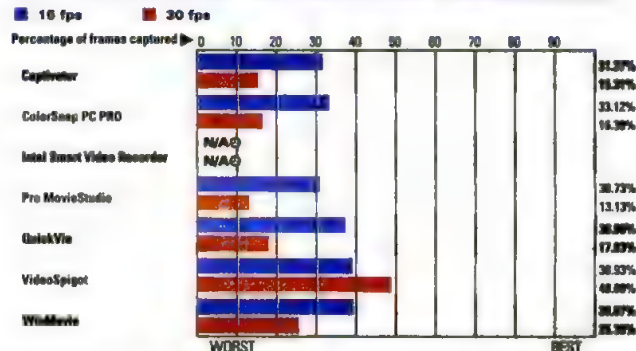
HARDWARE-ASSISTED VIDEO CAPTURE



N/A—Not applicable. This board does not offer hardware-assisted capture.

The chart at right shows the percentage of frames captured in our 10-second clip, at both 30 and 15 fps in 24-bit color mode. The chart above presents the percentage of frames captured using the best hardware-assisted capture mode by each board.

24-BIT RAW CAPTURE



N/A—Not applicable. The board does not support this capture mode.

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the least amount of image detail. Since the digitizing, editing, and compression process will degrade the video, it's better to start with a higher-resolution source. Hi-8 camcorders and VCRs will deliver a better picture using an S-video connection (about 400 horizontal lines of resolution versus the 300 or so lines delivered by standard VHS). For premium quality video, use a professional VTR (video tape

recorder) or laserdisk player (450 horizontal lines of resolution).

WHAT'S COMING?

The next six months promise to be a boom for desktop PC video. Three products based on Auravision's video chip—the Diamond Video Star, the Orchid Vidiola, and the Hauppauge WinTV—looked promising in PC Magazine Labs

tests, but were not ready for release at the time of review. Several dedicated cards that speed up decompression and boost playback to a full-screen size are also due out on the market. Sigma Designs was the first to introduce a \$449 MPEG playback board, and several other companies are expected to introduce similar products soon. Meanwhile, VGA graphic adapter designers Tseng Laboratories and ATI Technologies are improving video playback by building interpolation schemes into their accelerator chips.

VideoLogic Inc.

Captivator

ALL REVIEWS BY JOHN R. QUAIN

It doesn't boast hardware-based compression or offer the lowest price, but VideoLogic's \$349 Captivator does a fair job of capturing video clips. Furthermore, it supports a wide variety of capture modes and sizes.

Captivator can capture video in color depths ranging from 24-bits to 8-bit palletized format, and it supports both composite and S-video modes. Moreover, the board allows you to capture video in any window size from 32 by 32 pixels to 640 by 480 pixels (the only other board in this review with this capability is Media Vision's Pro MovieStudio). This feature is particularly helpful if you need to capture a specific-size video window for a presentation but don't have the benefit of hardware-based scaling or interpolation during playback.

VideoLogic recommends capturing files in YUV mode, and tests performed in that format generally resulted in better image and motion quality than those performed using the RGB setting. In YUV mode, Captivator didn't drop any frames from a 10-second, 30-fps clip in sizes up to 160 by 120 pixels. However, at 320 by 240 pixels in YUV mode, it dropped nearly 85 percent of the frames.

You can improve on this by cutting the frame rate to 15 fps, at which Captivator was able to capture all the frames, or choose a lower color depth to reduce the number of frames dropped. Nonetheless, we could not match Captivator's claimed ability to capture video



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at 30 fps in a 320- by 240-pixel window size. And in RGB mode, we found that the board dropped frames even in the choppy 15-fps rate using a 240- by 180-pixel window.

VideoLogic bundles its own basic VideoSnap Windows capture software with the Captivator board. VideoSnap offers the added benefit of being able to take still-image captures from a motion video source without a lot of fuss. During recording, the preview window displays a grayscale image of the incoming video that enables you to tell when to stop the capture.

The only gripe we had with Captivator was its nettlesome installation. Although the user manual provides detailed instructions, we eventually had to reinstall Windows to get everything working in concord.

► **Captivator.** List price: with *Microsoft Video for Windows 1.0*, *VideoSnap*, \$349; with *Macromedia Action!* added, \$399. VideoLogic Inc.; 800-578-5644, 617-494-0530.

Circle 509 on reader service card

Computer Friends Inc.

ColorSnap PC PRO

Missing frames and choppy motion are facts of desktop video life. Unfortunately, Computer Friends' relatively high-priced ColorSnap PC PRO (\$649) fails to match even the limited performance of capture boards that cost hundreds of dollars less.

Like the majority of the capture boards in this roundup, ColorSnap relies on software-based compression. It includes a version of JPEG compression, which works only on still images. It also lets you adjust the compression ratio, depending on the image quality desired.

Although the ColorSnap software indicates that it can store full-motion video in either RGB or YUV modes, we could only get the board to create .AVI files using the RGB setting. Attempts to use YUV capture ended in Windows crashes, and repeated calls to the company failed to resolve the problem.

In capture tests at 15 fps, ColorSnap managed to capture all the frames in a 160-by-120 window using 24-bit color. Unfortunately, ColorSnap does not allow video capture in a 240-by-180 window. And in the larger 320-by-240 size, ColorSnap missed 67 percent of the frames in a 10-second clip.

Moving up to the 30-fps setting with 24-bit color, the card dropped about 84 percent of the frames in a 320-by-240 window. Reducing the color depth to 16-bits will improve performance slightly (the board missed less than 73 percent of the frames in this mode), but if you're trying to capture as many frames as possible, you're better off sticking with the 24-bit color depth and using the smaller 160-by-120 window, in which ColorSnap missed about 49 percent of the frames in PC Labs' test video clip.

Unfortunately, the high percentage of dropped frames isn't the only drawback: Image quality was also substantially below-average. Captured 24-bit clips demonstrated muted colors. Software-based compression further deteri-

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GRAPHICS

Video-Capture & Editing Tools

orated the image, though not quite to the same degree as the Jovian and Sigma boards.

The one bright spot we found was ColorSnap's straightforward installation. The card's default settings worked on PC Labs' test-bed. If you do run into trouble, however, you'll have to contend with jumper settings and an owner's manual that is skimpy to say the least.

Overall, ColorSnap from Computer Friends fails to measure up against competing video-capture boards.

► **ColorSnap PC PRO.** List price: \$649. Computer Friends Inc.; 800-547-3303, 503-626-2291.

Circle 503 on reader service card

Media Vision

Pro MovieStudio

One of the top performers in this roundup, Media Vision's \$449 Pro MovieStudio offers several attractive features, including hardware-based compression, superior ease of use, and convenient software controls. On the other hand, its lack of 24-bit color support and its reliance on Microsoft Video 1 compression means it's more appropriate for straightforward business applications than serious editing or multimedia application work.

The salient feature of the board is its hardware-based Video 1 compression support. Originally developed by Media Vision for Microsoft VFW, the Video 1 codec supports 16-bit color, which is sufficient for most desktop applications. And in tests using the hardware-based compression, it captured a 10-second video clip in a 320-by-240-pixel window at 30 fps without dropping frames. However, the image detail and color fidelity of Video 1 is still somewhat disappointing, producing noticeably reduced color accuracy and image sharpness.

You'll get better results in terms of image clarity by using Pro MovieStudio's RGB capture mode, but only by sacrificing frames. In RGB capture mode using a 320-by-240 window, the Pro MovieStudio lost about 87 percent of the frames at the 30-fps setting and about 50 percent of frames in 15-fps mode.

Aside from its hardware-based com-

pression, Pro MovieStudio's other major strength is its ease of use. Among these rather unruly video-capture cards, Pro MovieStudio proved simple to install, without any of the jumper headaches encountered with other boards. All address and IRQ settings are selected through the setup software.

Furthermore, Media Vision's software allows you to scale the capture window from 44-by-32 up to 320-by-240 pixels, or to a full-screen 640-by-480 size. You can also modify images by adjusting the color gain, hue, horizontal and vertical centering, and by selecting various filters.

Media Vision fills out the package with a three-year parts-and-labor warranty, a toll-free technical support number, and a copy of Macromedia's object-oriented Authorware Star for creating your very own multimedia training and instruction applications. All in all, Pro MovieStudio is a very strong contender for business users looking to get some ideas down on video.

EDITORS' CHOICE ► **Pro MovieStudio.** List price: \$449. Media Vision; 800-845-5870, 510-770-8600.

Circle 507 on reader service card

Jovian Logic Corp.

QuickVia

In a generally disappointing group, Jovian Logic Corp.'s QuickVia video-capture board distinguished itself as a particularly disappointing performer. One of two identical boards in this roundup (the other is Sigma Designs' WinMovie), the \$299 QuickVia was plagued by installation difficulties and poor image-capture quality in PC Labs' tests.

QuickVia can capture video clips in standard RGB mode or its own proprietary Video 8 format in color depths of up to 24 bits. The card accepts composite and S-video sources, and a version that supports stereo 16-bit, 44.1-kHz audio is available for \$399.

In PC Labs' video-capture tests, the QuickVia was one of the poorest performers in terms of image quality and frame-capture rates. The QuickVia dropped frames in every color depth and capture size larger than 160 by 120 pixels. In 24-bit RGB mode, for example, it

dropped 82 percent of the frames of a 10-second, 30-fps clip in a 320-by-240 window, and 63 percent of frames when switched to 15-fps mode. Because QuickVia does not include hardware-based compression, we could not improve on this frame rate.

Furthermore, the uncompressed RGB clips captured with the QuickVia compared poorly with those captured with other boards in the same format. Once the files were compressed using Cinepak, the situation deteriorated further, with the compressed clips exhibiting a higher-than-average number of block artifacts and substantial pixelation.

Jovian bundles its own software with the QuickVia that is simple enough to use for most basic editing tasks. The software offers a VCR-style graphics interface, and it allows you to correct the position of the preview image. This proved particularly helpful in adjusting misaligned images and eliminating some horizontal banding near the top of the captured image.

Unfortunately, depending on your PC's configuration, you may find QuickVia difficult to install. After several unsuccessful attempts to set the board up properly for PC Labs tests, we finally had to reinstall Windows and start the setup using a "clean" system.

Although QuickVia offers a competitive price (about \$250 through dealers), shoppers will find that boards such as VideoSpigot for Windows deliver better performance for the same price.

► **QuickVia.** List price: \$299. Jovian Logic Corp.; 510-651-4823.

Circle 506 on reader service card

Intel Corp.

Intel Smart Video Recorder

Leading the pack in performance, the Intel Smart Video Recorder is the clear choice for those seeking to capture video on a PC. The \$699 Intel offering is the most expensive board we tested, and its hardware-based compression outstrips the competition in terms of image quality and frame-capture rates.

In order to deliver superior performance, the full-length Smart Video Recorder card focuses on doing just a few

tasks, but it does them very well. It supports only two capture formats: the uncompressed YUV9 and the company's Indeo 3.11 codec. The latter employs hardware support for real-time compression, although decompression during playback is performed via software.

In our 15-fps video-capture tests, the Smart Video Recorder did not drop any of the frames in PC Labs' 10-second test

clip using either YUV9 or Indeo capture modes. Furthermore, Indeo compression on a 30-fps, 320-by-240 video clip dropped only 49 percent of the frames at its default setting.

Nonetheless, the Smart Video Recorder does lack a degree of flexibility. To capture video in a 240-by-180 window, for example, you must use Indeo compression (although a new driver,

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SUMMARY OF FEATURES

Video-Capture Boards

	PC MAGAZINE EDITORS' CHOICE		PC MAGAZINE EDITORS' CHOICE				
In alphabetical order by company	Computer Friends Inc. ColorSnap PC PRO	Creative Labs Inc. VideoSpigot for Windows	Intel Corp. Intel Smart Video Recorder	Jovian Logic Corp. QuickVia	Media Vision Pro MovieStudio	Sigma Designs Inc. WinMovie	VideoLogic Inc. Captivator
List price	\$649.00	\$399.95	\$699.00	\$299.00 (\$399.00 with audio)	\$449.00	\$299.00	\$349.00 (with Microsoft Video for Windows 1.0); \$399.00 (with Microsoft Video for Windows 1.0, Macromedia Action!)
Toll-free number	800-547-3303	800-998-5227	800-538-3373	None	800-845-5870	800-845-8086	800-578-5644
Toll number	503-626-2291	408-428-6600	503-629-7354	510-651-4823	510-770-8600	510-770-0100	617-494-0530
Fax number	503-643-5379	408-428-6611	503-629-7580	510-651-1343	510-770-9592	510-770-2640	617-494-0534
Bundled video-capture software	Aldus Photo-Styler SE, Fast-Compress	Microsoft Video for Windows 1.0	Asymetrix Compel and MediaBlitz!, GateKeeper, Microsoft Video for Windows 1.1	Microsoft Video for Windows 1.0, Xing Technology Picture Prowler	Microsoft Video for Windows 1.0	Microsoft Video for Windows 1.0, Xing Technology Picture Prowler	Microsoft Video for Windows 1.0
Users can uninstall software	☐	☐	☐	☐	☐	☐	☐
Includes cables	☒	☐	☒	☐	☐	☐	☐
General Features							
Resolution and frame rate for motion video capture:							
80 x 60 pixels: 15 fps, 30 fps	☒	☒	☒	☒	☒	☒	☒
160 x 120 pixels: 15 fps, 30 fps	☒	☒	☒	☒	☒	☒	☒
320 x 240 pixels: 15 fps, 30 fps	☒	☒	☒	☒	☒	☒	☒
640 x 480 pixels: 15 fps, 30 fps	☐	☐	☐	☐	☐	☐	☐
Color depths supported:							
256 (8-bit)	☒	☒	☒	☒	☒	☒	☒
65,536 (16-bit)	☐	☒	☒	☒	☒	☒	☒
16.7 million (24-bit)	☒	☒	☒	☒	☐	☒	☒
Video signals supported:							
NTSC (U.S.)	☒	☒	☒	☒	☒	☒	☒
PAL (Europe/Japan)	☒	☒	☒	☒	☒	☒	☒
S-video (baseband)	☒	☒	☒	☒	☒	☒	☒
Composite	☒	☒	☒	☒	☒	☐	☒
Number of video inputs/outputs	3, none	2, none	2, 1	2, 1	2, none	2, none	2, none
Number of audio inputs	None	2	None	3	2	None	1
Playback	☐	☒	☒	☒	☐	☒	☐
Video preview	☒	☒	☒	☒	☒	☒	☒
Warranty	1 year	1 year	3 years	2 years	3 years	5 years	1 year
Compression							
Hardware-assisted video capture	☐	☐	☒	☒	☒	☐	☒
Hardware-based compression	☐	☐	☒	☐	☒	☐	☐
Software-based compression	☒	☒	☒	☒	☒	☒	☒
Compression formats supported:							
Cinepak	☐	☒	☐	☒	☐	☒	☒
Indeo	☐	☐	☒	☒	☐	☒	☒
JPEG	☒	☐	☐	☐	☐	☒	☐
MPEG	☐	☐	☐	☐	☐	☐	☐
QuickTime	☐	☐	☐	☐	☐	☐	☐
Ultimedia	☐	☐	☐	☒	☐	☒	☐
Video for Windows links	☒	☒	☒	☒	☒	☒	☒
Other drivers included	None	None	None	OS/2 Video-In	None	None	None
FCC class rating	Class B	Class B	Class B	Class B	Class B	Class B	Class A

* Supported through bundled software.

Video-Capture & Editing Tools

unavailable for testing, now supports that mode in YUV9), while a 640-by-480 image requires YUV9. Furthermore, there is no built-in still frame-capture utility.

On the other hand, the overall image quality of the Smart Video Recorder's captured AVI files is superior to any of the other cards in this roundup. Clips captured using YUV9 proved to be sharper and more detailed than those captured with competing boards (although some loss of color was apparent). In addition, the Indeo 3.11 codec allows you to adjust the image quality in relation to the compression rate. Unfortunately, better image quality translates into a lower compression ratio, and a greater number of missed frames.

The Intel Smart Video Recorder package includes Asymetrix Corp.'s Compel for business presentations and Media-Blitz! for organizing your multimedia work. The board also includes VFW 1.1 and GateKeeper, Vol. 1, by Firstlight. To round out this already attractive bundle, Intel provides a three-year parts-and-labor warranty.

EDITORS' CHOICE ▶ **Intel Smart Video Recorder.** List price: \$699. Intel Corp.; 800-538-3373.

Circle 505 on reader service card

Creative Labs Inc.

VideoSpigot for Windows

Originally introduced by SuperMac Technology in 1992, VideoSpigot for Windows has maturity and experience on its side. In PC Labs' video-capture tests, the \$299 board, now exclusively licensed from SuperMac by Creative Labs, turned out some of the best video captures in this under-\$700 class.

VideoSpigot is able to capture video in a variety of formats and color depths, including straight 24-bit RGB, YUV 4:2:2, and proprietary Spigot compression. Furthermore, SuperMac's experience as the developer of the increasingly popular Cinepak codec gives it an image-quality edge over the competition.

In our tests, VideoSpigot dropped 61 percent of the frames out of a 10-second, 320-by-240 clip in 24-bit, 15-fps RGB capture mode. The card's YUV capture fared

significantly better, however, losing only 43 percent of the frames in the 320-by-240 window.

VideoSpigot's Spigot compression software provides the smoothest motion clips, however. Test captures using the Spigot codec on a 30-fps, 320-by-240-pixel video clip dropped only 51 percent of the available video frames. Conversely, those users who are looking to perform digital video editing will be pleased to note that RGB captures later compressed with Cinepak yielded some of the most pleasing AVI files we created in this roundup.

Creative Labs doesn't bundle any extensive authoring or editing software with VideoSpigot, but a control panel in VidCap, an included Microsoft Video for Windows utility, will allow you to adjust the color and hue and set the board to detect an S-video or regular composite video source automatically. And like most of the boards we looked at for this this roundup, VideoSpigot will recognize different broadcast standards, including the NTSC (North America Television Standard Committee) and PAL, a European broadcast standard.

Novices should not be intimidated by VideoSpigot. Setting up the board is nearly effortless, and Creative Labs supports it with a standard one-year parts-and-labor warranty. Sure, with a street price of about \$250, VideoSpigot won't give you any snazzy multimedia authoring software, but you won't get any headaches, either.

▶ **VideoSpigot for Windows.** List price: \$299. Creative Labs Inc.; 800-998-5227, 408-428-6600; fax, 408-428-6611.

Circle 504 on reader service card

Sigma Designs Inc.

WinMovie

WinMovie is Sigma Designs' version of Jovian Logic Corp.'s QuickVia video-capture board. Also priced at \$299 and bundled with the same software, WinMovie has all of QuickVia's features and, unfortunately, all of its shortcomings as well.

Like the Jovian board, WinMovie supports only software-based compression, but it does allow you to capture video in color depths ranging from 8 to 24 bits. Though the card does not support the YUV format, it does let you capture video in standard RGB mode or in the same proprietary Video 8 mode as Jovian's board. WinMovie also supports Cinepak, Indeo, and JPEG compression.

In our capture tests, WinMovie's performance paralleled that of QuickVia.

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Video-Capture & Editing Tools

Although Sigma's model consistently dropped fewer frames than the Jovian board, WinMovie still missed frames in all of the 24-bit RGB modes we tested above the 160-by-120 window size. Furthermore, WinMovie's image quality offered no improvement. After undergoing software-based compression, for example, WinMovie's clips revealed the same block-shaped image artifacts as QuickVia's. And although the proprietary 8-bit, Video 8 capture mode comes closer to capturing a full 30-fps, 320-by-240 video stream, significant color quality is sacrificed in the process.

Furthermore, like Jovian's QuickVia, WinMovie proved somewhat troublesome to install. Jumper settings on the board had to be changed in order for it work on PC Labs' test-bed. Also, because the software drivers do not automatically recognize the jumper settings, interrupt assignments had to be manually changed on the software control panel as well.

Like QuickVia, WinMovie ships with capture software that uses a VCR-controls metaphor. It simplifies tasks such as capturing a single frame of video and lets you adjust the brightness, contrast, hue, saturation, and image position of a live video signal in the preview window.

Sigma Designs recommends you use this board in at least a 33-MHz 386 CPU-class machine. The company also suggests you have 4MB of RAM and 6.5MB of hard disk space for the accompanying software. Most other boards feature similar hardware requirements.

The only thing that sets WinMovie apart from the Jovian board is that Sigma Designs bolsters its offering with a longer five-year parts-and-labor warranty. But because the company was not able to extend the card's performance, this may not be enough to convince shoppers to buy the board.

► **WinMovie.** List price: \$299. Sigma Designs Inc.; 800-845-8086, 510-770-0100.

Circle 508 on reader service card

device that is compliant with MCI or ViSCA (Video System Control Architecture). To a large degree, these options will be similar from program to program because many of the capture functions are by necessity built upon the system-level capabilities provided by the Microsoft VFW Developers' Kit (or in the case of OS/2, by IBM Ultimedia Video IN/2).

Once the video is stored safely on-disk, the software should provide a full-function electronic production studio. Just like its counterparts in the analog world, these functions must encompass mundane tasks as well as creative activities. You can't produce even the simplest video if you can't import a wide variety of file formats from external sources, such as CD-ROM clip-media libraries.

Where moving images are concerned, your package should support Macintosh QuickTime clips, the Autodesk animation .FLC/.FLI format, and all flavors of Microsoft AVI (Cinepak, Intel Indeo 3.1, Microsoft Video 1, RLE, uncompressed video, YUV, and even IBM's Ultimotion codec). The program should import common formats for audio (such as standard .WAV files and the .VOC files produced by the ubiquitous Creative Labs Sound Blaster cards) as well as cutting-edge formats (such as ADPCM compressed audio) directly into the workspace.

Support of still images must be even more wide-ranging to accommodate the multitude of bitmapped graphics programs and screen-capture utilities in use. So in addition to the expected support of .BMP, .DIB, .GIF, .PCX, and TIFF, you should have access to high-end formats

such as JPEG, PhotoCD, and Targa.

Just assembling all of these disparate elements into a single AVI file requires something more than basic cut-and-paste functions because you must synchronize images and sounds. So just as rulers measure

inches, a video-editing program must measure time. It does so by using the SMPTE (Society of Motion Picture and Television Engineers) time code (hours: minutes: seconds: frames). A program

Video-Editing Software

BY LOUISA SIMONE

Digital video production on the PC is like a jigsaw puzzle: Most of the pieces have to be in place before the picture makes much sense. Video-capture boards have been available for a while, but two important pieces of the puzzle—capture and editing software—have traditionally been limited in both number and scope.

Those limitations, however, are quickly disappearing due to a number of factors, including the appearance of better software-based compression, a growing installed base of digital video producers and content developers, and Microsoft's decision to withdraw from the end-user market and instead position Video for Windows (VFW) as a developers' kit. With this in mind, we review five relatively new video-editing packages: Adobe Premiere for Windows, Version 1.1; ATI MediaMerge, Version 1.0; IBM Ultimedia Video IN/2, Version 1.0; MediaRecorder from Lenel Systems International; and Splice!, Version 2.0.

The truth is that not one of the products listed above provides a complete video-editing toolkit. The reason is simple: The video-editing process is complex and, especially where creative special effects are concerned, open-ended. But while it may be impossible for a software company to actually build the perfect program, it's easy for us to describe our ideal version of a PC-based video-editing application.

WHAT WE NEED

First and foremost, a program must provide basic video-capture functions, such as the ability to specify the frame size, frame rate, and codec for the incoming data. You should also be able to choose between real-time capture, where you manually control an external video source, or frame-step capture, where the program itself can digitally control a video

The ideal video-editing program should offer electronic equivalents of common techniques found in a video studio.

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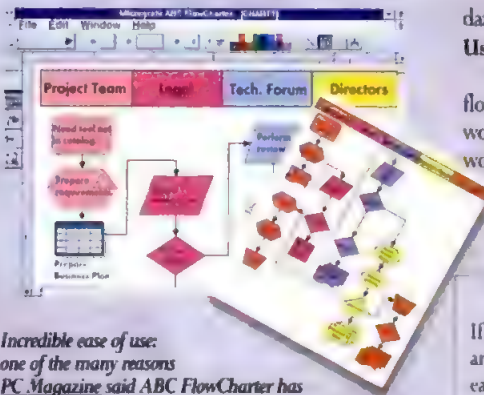
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must provide several tools to control synchronization, including inserting markers into a video interactively while it's playing, and positioning elements schematically on a multitrack timeline.

Attempting to blend all of your source material together into a work of cinematic art requires you to use more powerful tools that can actually change the content and not just the duration of a video or sound file. The ideal video-editing program should offer electronic equivalents of the three most common techniques found in a traditional video studio: transitions, overlays, and titles.

SPECIAL EFFECTS

It is certainly great to have a wide variety of canned transition effects (such as wipes, zooms, and dissolves) to choose from. A video-editing program should also duplicate the most common technique used in professional video studios: *superimposition* (also called "video compositing" or "overlays"), whereby portions of a video image are made transparent so that an underlying video image can

show through. It's a technique regularly used during the weather segment of your favorite local newscast.

Most importantly, however, a video-editing program must keep track of the workspace (which consists of imported files, internally generated titles, the timeline sequence, transition effects, and any video or audio filters) in an uncompiled state. Stored in a special project file, all of this information can be previewed, reviewed, and altered as you deem fit. It is not

until you choose to produce the clip that your editing changes are applied to the source material and compiled into a final .AVI file.

When the moment finally arrives to produce your video clip, a good program makes the process easy—not by ignoring the difficult issues, but by presenting you with simple point-and-click options while handling all of the really thorny problems in the background.

Though it's a tall order, a video-editing program should make all of these functions accessible and understandable to end users. Sometimes a program accomplishes this task by borrowing interface conventions from traditional video devices. All of the programs, for example, offer player or preview windows that use standard VCR controls for play, stop, rewind, and fast-forward commands.

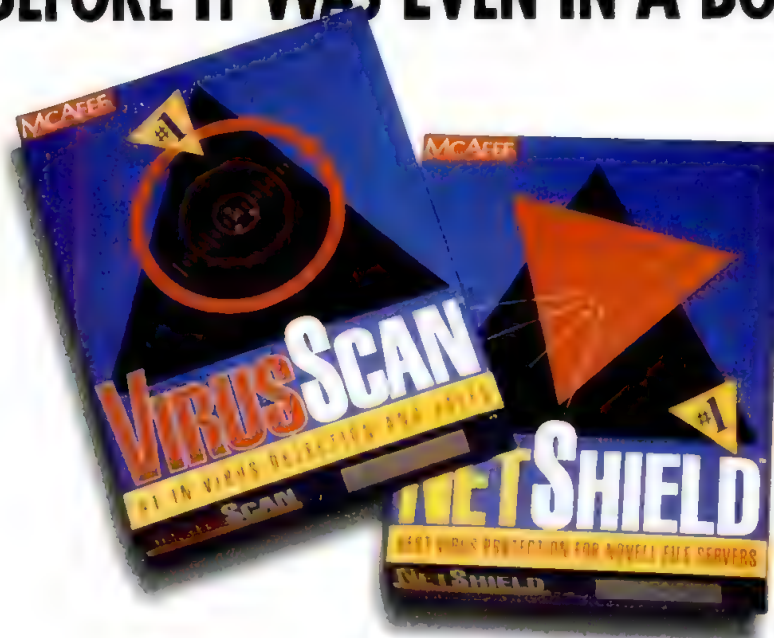
Another convention borrowed from the world of professional video production

is the storyboard, in which single frames are used to represent each scene in a longer clip. Video-editing packages also use timelines, which are common interface devices that have the dual advantage of showing you the duration of a particular event as well as the way in which events overlap one another, either for synchronization or superimposition purposes.

Unfortunately, you can't go to your

*You still can't buy
the ideal video-
editing program.*

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Video-Capture & Editing Tools

local computer store and buy the ideal video-editing program. But you can read through our real-world testing and measure each of the five products against the ideal program described above. Our test-bed included a 486/66 system with 16MB of RAM, the Creative Labs Sound Blaster 16 audio board, and a video-capture card—an Intel Smart Video Recorder for the Windows-based programs and Jovian Logic Corp.'s QuickVia for the single OS/2 program.

ADOBE PREMIERE

If you see yourself as the next George Lucas, Adobe Premiere, Version 1.1, may be just the program for you.

The distinguishing feature of this \$295 program is its ability to manipulate the contents of a video clip via 33 image-editing filters. In addition to production-oriented filters—such as contrast, brightness, and color balance—Adobe Premiere adds truly artistic effects such as solarize, ripple, and pointillize. If these filters sound familiar, it's because they are identical to Adobe Photoshop functions. Indeed,

Adobe Premiere can utilize any Photo-shop-compatible filter.

Adobe Premiere's ability to combine its unique image-editing filters with 35 customizable transition effects and professional overlay options makes it a truly flexible and therefore creative tool. And Adobe Premiere often supplements standard video-editing functions with high-end alternatives. For example, in addition to Chroma-Key and luminance-transparency effects, Adobe Premiere supports garbage matte (great for split-screen effects) and alpha channels (256-level gray-scale masks created in high-end image-editing programs).

Version 1.1 is shipping close on the heels of Premiere 1.0 and is free to all registered users. The program boasts many new features, including a bundled clip-media CD-ROM. But the biggest addition is the full-featured AdobeCap video-capture module. AdobeCap offers all of

the recording functions you'd expect—such as the ability to specify a data rate or create an optimized palette—as well as a few extras, including a time-lapse record mode that captures a stream of still images at specified intervals.

Of course, Adobe Premiere is not perfect, especially when compared with its

more robust and more expensive Macintosh sibling (\$695). Unlike the Mac version, the Windows-based Adobe Premiere does not offer titling functions, video along a

path, or 99 editing tracks. Indeed, Adobe Premiere's limited number of editing tracks (two video tracks, three audio tracks, one transition, and one superimposition track) is the most inefficient feature of the program.

With a somewhat complex toolbox and a host of customization options, Adobe Premiere takes some time and effort to master. But the paybacks are fast response times, speedy RAM-cached pre-

*Adobe Premiere can
manipulate a video clip
via 33 filters.*

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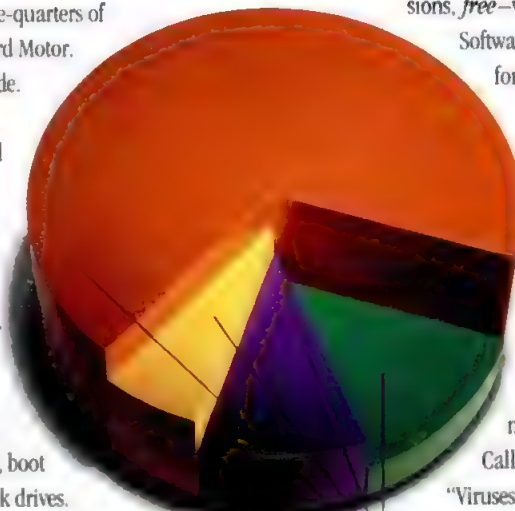
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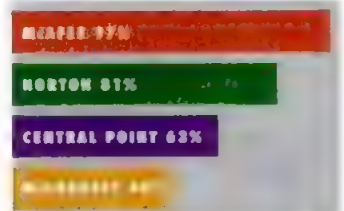
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Video-Capture & Editing Tools

views, and an extremely efficient workspace. Overall, Adobe Premiere gets high points for performance, productivity-oriented features, and the quality of final output.

► **Adobe Premiere for Windows, Version 1.1.** List price: \$295. Adobe Systems Inc.; 800-2272-3623.

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ATI MEDIAMERGE

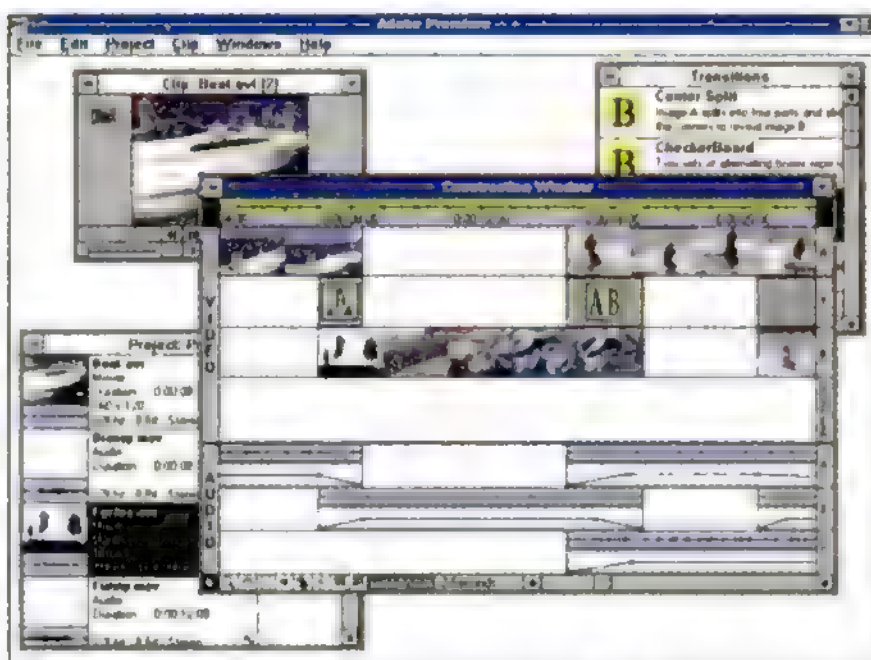
If you feel at home with business graphics programs, you'll find ATI MediaMerge, Version 1.0, to be the perfect introduction to video editing. That's because this \$299 product has a unique module that looks and works much like the slide sorters common to presentation-graphics programs.

Called the Storyboard Editor, this portion of ATI MediaMerge lets you quickly sequence moving images (in the .AVI, .FLC/.FLI, or .MOV formats) and still images by simply dragging thumbnail representations of each file around the workspace.

Segues between each clip are easy to produce thanks to nine types of transition effects, including wipes, dissolves, and venetian blinds. Self-explanatory dialog boxes allow you to customize both the duration and execution of each transition effect. For example, the Spot Wipe effect can use one of several different shapes including a circle or an expanding cross.

As your productions grow more ambitious, you'll find that ATI MediaMerge provides more advanced tools called the Scene Editor and Audio Editor. The Scene Editor differs from other utilities by offering 16 video tracks, each of which accommodates audio information as well as superimposition effects. Titling is one of the most useful functions in the Scene Editor. Using the special dialog box, you can type up to 256 characters, assign any TrueType font, and animate the words with admittedly limited, but oh-so-easy options. The Audio Editor's ability to manipulate the right and left channels of stereo sound independently, coupled with 14 different audio filters, lets you create a true soundtrack for your video clips. Certain filters, such as Gain and Find Peak, let you correct poorly

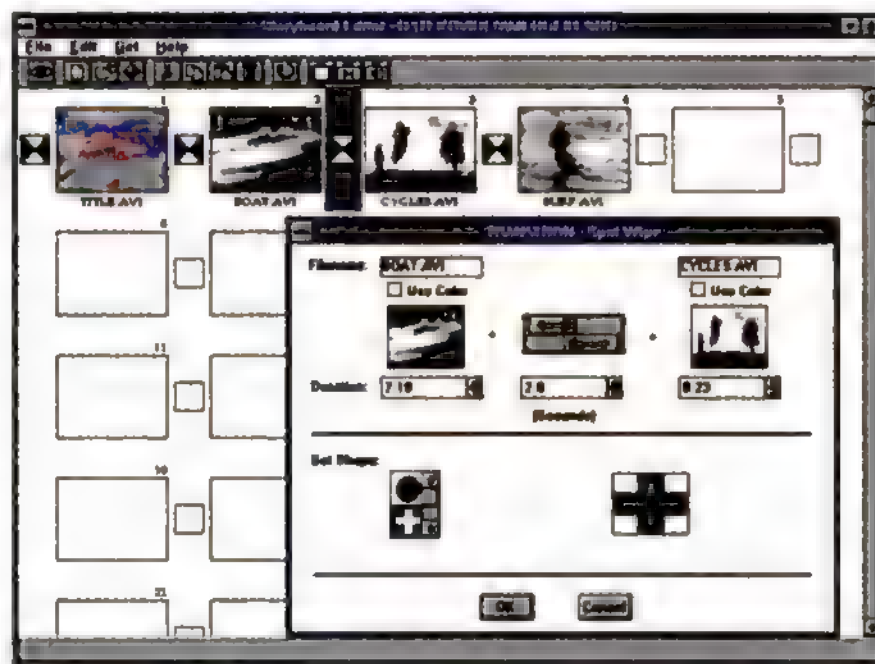
recorded audio, while others, such as Reverb and Mix Loop, let you create wholly new sound effects. MediaMerge is also the only program in this roundup to support the Sound Blaster's .VOC format—a



Adobe Premiere's Clip window lets you play clips and interactively insert up to ten markers for highly accurate alignment across video and audio tracks.

real convenience for anyone overdubbing a narration.

With three robust editing modules and a CD-ROM of sample media clips, ATI MediaMerge is a real value. But be aware that ATI is currently working on a free upgrade, Version 1.1, that will address the most glaring shortcomings of the current version, including support for the Indeo



ATI MediaMerge offers a unique Storyboard Editor that lets you quickly assemble video clips and transition effects. Notice the easy-to-understand transition dialog box.

3.1 codec (rather than 2.1) as well as a fix for the current bug that prevents LZW-compressed TIFF files from importing.

► **ATI MediaMerge, Version 1.0.** List price: \$299. ATI Technologies Inc.; 416-882-2600.

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IBM ULTIMEDIA VIDEO IN/2

If you plan to produce digital video clips on the OS/2 platform, you have only one software option: IBM's \$199 Ultimedia Video IN/2, Version 1.0. Video IN/2 serves two distinct purposes. First and foremost, it is an extension to the OS/2 environment that, in conjunction with the bundled programmers' toolkit, allows third-party developers to build video-editing applications. But it also services end users who need an OS/2-based video-capture utility.

Video IN/2 is not a full-blown video-editing program. For example, all of the commands on the Edit menu are simple operations in which you cut from a single source file and paste in a single target file. Also, the program does not support multiple tracks, superimpositions, transition effects, or image-editing filters.

When it comes to capture, Video IN/2 offers basic functions: You can choose between real-time or frame-stepped recording modes, and you can specify the size, rate, and codec for incoming data. Video IN/2 takes advantage of the 32-bit, multi-threaded OS/2 environment to provide high-performance capture-and-playback. But this is true only if your system contains at least 12MB of RAM and the absolutely most current video drivers.

During our testing, for example, older S3 drivers, which do not support direct video output, dropped the capture rate to an unacceptable 10 frames-per-second.

At the moment, Video IN/2 ships with drivers for only seven video-capture boards and offers no way to play Ultimotion-compressed videos under Windows. However, IBM's multimedia evangelism guarantees future upgrades to Video IN/2. In the works are support of Indeo 3.1 (instead of the current 2.1) and an Ultimotion codec for Windows playback. But until third-

party hardware and software developers step up to the plate, video production under OS/2 will be severely limited.

► **IBM Ultimedia Video IN/2, Version 1.0.** List price: \$199. IBM Personal Software Products Division; 800-887-7771.

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Video-Capture & Editing Tools

MEDIARECORDER

If you want to capture a large number of video clips with the least amount of fuss and bother, you should consider the very specific functions offered by the \$149 MediaRecorder from Lenel Systems International. Without editing functions of any kind (the program doesn't even support cut-and-paste between digital video clips), MediaRecorder is a production-oriented video-capture utility.

The strength of this product lies in its fully integrated control of external video and audio sources via MCI or ViSCA commands. Thus, in addition to the

► **MediaRecorder 1.5.** List price: \$149; **MCI Multimedia Drivers Kit.** List price: \$199. Lenel Systems International Inc.; 716-248-9720.

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SPLICE!

If you want to spice up your clips with effects such as video along a path, Splice!, Version 2.0, (\$295) is the program for you. Splice! achieves these effects while differentiating itself from the competition with the Path Manager. On the simplest level, the Path Manager works with the titling module, several transition effects, or any image on the overlay track to move type (in either Adobe Type 1 or TrueType formats), wipes, and video across the screen. Creating the path is as simple as clicking a series of points in a specially provided dialog box. The ability to apply rotations, durations, and magnification factors to each point along the path allows you to create flying, twirling, and zooming video effects.

On a more general note, Splice! is a well-rounded video-editing program. A capture module that fully supports VFW

1.1 gives you control over MCI-compliant devices, palette optimization, and data rate. While not as powerful as the batch mode features found in MediaRecorder, Splice! does allow you to capture up to ten designated video clips in batch mode, although you'll have to type in the SMPTE time codes for each segment manually.

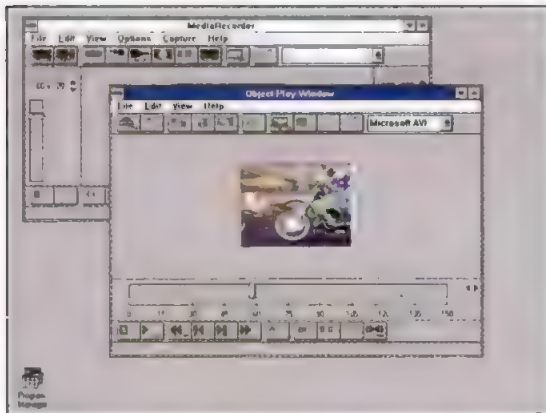
In many ways, Splice! and Adobe Premiere have similar interfaces, with individual windows to play, organize, and assemble the various clips and the images that your clip comprises. And like Premiere, Splice! offers only four editing tracks—two for video, one for transitions, and one for overlays. But those four tracks offer an amazing amount of functionality. For example, Splice! lets you apply its production-ori-

ented image-editing filters (for brightness, contrast, color balance, and saturation) to individual frames within a longer clip, which allows you to alter the strength of the filters over time.

Splice! does have room for improvement. At the moment, the program supports a wide variety of file formats, including .AVI, .FLC/.FLI, and .WAV, but not QuickTime clips. And its two transparency options (Chroma-Key and key-color) should be augmented with more powerful masking options. Screen redraws of the workspace are annoyingly slow—so much so that we were forced to display only filenames in the timeline. And because previews are always computed in real time, playback is jerky, even on a fast machine.

When it comes to producing a finished full-motion video clip, however, we have no complaints about either the performance or output quality of this program. Support for the full range of codecs and a feature that will not unnecessarily recompress already-compressed files contributed to good-looking, smooth-playing video.

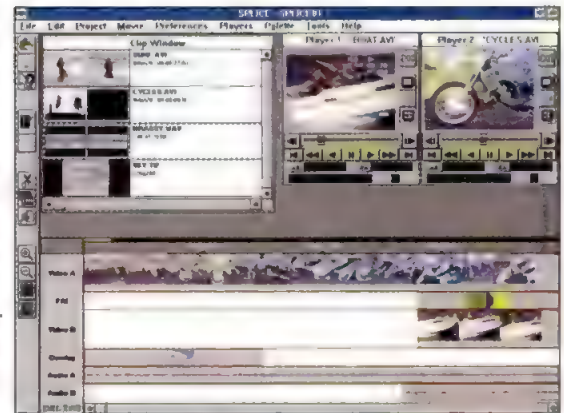
As proof that this is a fast-moving market, both an upgrade and a major new release of Splice! have been announced. Version 2.1, which promises performance



MediaRecorder offers simple playback functions, shown here in the Object Play window. However, many of the functions are available only if your system includes an MCI- or ViSCA-controlled video source.

frame-stepped capture modes offered by other products, MediaRecorder can capture an unlimited number of video clips in batch mode. Best of all, you can create your batch processing instructions without troubling to jot down SMPTE time codes or frame numbers because MediaRecorder builds the batch list (called a *storyboard*) automatically and interactively as you play and mark video segments. You can then set the capture parameters, which can be as straightforward as choosing a codec or as complex as determining the optimal interleave factor for audio and video, and go to lunch while MediaRecorder creates your video clips unattended.

In the final analysis, however, MediaRecorder remains a one-trick pony. Chances are that only professional content developers will find it cost-effective to pay \$149 for a standalone video-capture utility.



Splice!'s Clip window allows you to organize the source files for a project. The timeline (bottom) contains four video tracks and is where you actually create all of the overlay, transition, and special pathing effects for your video clips.

boosts and a host of new image-editing filters and special effects, should be shipping free to registered users by the time you read this article. □

► **Splice!, Version 2.0.** List price: \$295. Splice Inc.; 717-286-6068.

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PEER-TO-PEER NETWORKS

Users have clear choices between high-end, feature-loaded performers built for growth and inexpensive, lower-end packages that still deliver the basics—file and printer sharing.



Peer Pressure

By Frank J. Derfler, Jr.

If you're curious about networking, but you think it could be complicated and costly, continue reading. If you're a sophisticated network manager or a value-added retailer who makes a living selling networks, you should continue reading as well.

Today's peer-to-peer LANs are like that. You'll find basic connectivity solutions for the smallest sites and relatively sophisticated network operating systems (NOSs) that are as easy to install as the basic packages, but full of features and poised for growth. There's something here for everybody. And, interestingly, pricing may play less of a role in your decision than the mix of ease of use, features, and potential for growth that you're looking for.

We set out in this roundup to gather products that answer the networking needs of a small workgroup of DOS and Windows systems. The primary requirement is the ability to allow at least ten client systems to access the same disk drive or set of files simultaneously across the network. We looked at a group of 13 peer-to-peer NOSs that offer a range of capabilities—everything

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from minimum file and printer sharing to e-mail, fax, remote access, scheduling, and the ability to expand upward and outward.

Our specification excludes the server-based NOSs that we review periodically, such as Novell's NetWare and Banyan's VINES, and products such as Digital's Pathworks and IBM's LAN Server, both of which have peer-to-peer abilities over other operating systems. Finally, rather than simple file transfer, we required file sharing, in which users can actually access directories on other users' hard disks. This cut out several other products (see the sidebar "Electronic Sneakernet?").

POLAR PEERS

In the products chosen for review, we observed a polarization between five packages designed for networks that need power and will grow, and five designed for low cost and easy installation. Three products sit somewhere in between.

Generally, in addition to their potential for growth, the five higher-end products have much better interfaces to Windows than the lower-end products do,

better printing features, more capability to do desirable things such as sharing CD-ROM drives, and more flexible networking connections. These five products are Invisible Software's InvisibleLAN, Artisoft's LANtastic, Microsoft Windows for Workgroups (WfWG), Novell's Personal NetWare, and Performance Technology's PowerLan. (We reviewed version 5.0 of LANtastic but also looked at a beta version of 6.0, expected to be released as we were going to press. See "Artisoft Ups the Ante" for more information.

Those products designed more for simplicity and low cost, which also means slower throughput, include Coactive Computing Corp.'s Coactive Connector, CBIS's Desk to Desk, Robertson-Caruso & Associates' LANLink Professional, Moses Computers' MosesALL!, and Artisoft's Simply LANtastic. Their principal value is for small two- to four-node networks.

(One product with truly unique practical appeal outside of the five designed for growth is Coactive Connector. It uses no internal adapters, so anyone harboring a phobia about probing a PC's innards can

remain calm. But it is extremely slow and costs about the same per node as the higher-end products.)

The other three products, Hayes Microcomputer Products' LANstep, NetSource's SilverNET-OS, and Tiara Computer System's 10NET LAN Operating System fall somewhere in the middle. These products embrace aspects of both ends, but do not fit decidedly at either. They are worthy products but may need to gravitate toward an area of strength as this market continues to divide. (D-Link Systems also markets a peer-to-peer OS, called LANsmart, that might have fit into this middle ground. LANsmart came to our attention after testing had been completed.)

That said, though, the higher-end products are becoming so ubiquitous (for example, Windows for Workgroups is installed at no extra cost on the hard disks of many new PCs) that the lower-level products will begin to feel real pressure in the market. If low-end products are to maintain an edge vendors will need to define their niche—markedly lower price and extremely easy installation and use,

HIGHLIGHTS

Peer-to-Peer Networks

THE PEER-TO-PEER NETWORKING

market is polarizing into high-end and low-end packages. The low-end packages deliver basic file and printer sharing; they are easy to install and often inexpensive. But they tend to be slow, and they do not scale up as well. The high-end products, with good features and performance, are packed with management capabilities. They are still well priced for networking, and they offer clear expansion paths.

MOST HIGH-END PRODUCTS

generally have better-designed interfaces and better Windows integration, which is important. Some include e-mail, network scheduling, and support for CD-ROMs and remote access. With most offering a 32-bit server option, a few of these high-end packages occasionally blur the line between peer-to-peer and more complex server-based net-

work operating systems (NOSs). But these packages also make it easier to migrate to—or integrate with—NetWare and other NOSs. They all work with standard Ethernet adapters and cabling.

OPERATING SYSTEM SUPPORT

is important. Many products have both Windows and DOS interfaces for management and for the various applications. But some—such as Windows for Workgroups (WfWG)—work well in only one environment. You have to buy DOS system support separately under WfWG. Hayes's LANstep is a complete operating system that essentially replaces DOS, but its Windows support is weak. Products such as PowerLan and LANtastic are easy to use under Windows or DOS, so it's easy to bring older systems onto the network.

SOME LOW-END

software/hardware bundles, such as Coactive Connector and MosesALL!, concentrate on making PC connections easy, while paying less attention to performance and compatibility. Coactive Connector is the simplest of them all: You don't even have to open the system unit, thanks to its parallel-port adapters. But you pay the price in performance.

HARDWARE IS A CONSIDERATION

at any level. Some products provide their own proprietary interface cards and cable, limiting your choices but guaranteeing easy technical support. Others use standard Ethernet or even Token-Ring or ARCnet cards, simplifying integration with existing or future networks. They also let you choose the type of cable best suited to your environment.

but still decent performance.

Another emerging distinction is that successful new peer-to-peer products overwhelmingly are Windows programs—and well-integrated at that. Networks simply must serve PCs running Windows. But the products here vary widely in how well integrated they are. Some, like Moses-ALL!, only run in a DOS box. And under LANstep, PCs acting as servers cannot run Windows in enhanced mode.

Of course, no NOS is as tightly integrated with Windows as Windows for Workgroups is. WFWG 3.11 is really a better version of Windows 3.1 with networking integrated. But if you don't want to upgrade all of your PCs to WfWG, and you still want well-integrated Windows networking, then PowerLan is your clear choice. Its Windows network icons and presentations are clearer than those in any other product here. PowerLan is, in fact, our Editors' Choice for its blend of ease of installation and use, excellent features, good performance, flexible pricing, scalability, and—this over WfWG—a good built-in integration of DOS systems with Windows systems.

IT STARTS WITH THE SIMPLE THINGS

When you first think about networking, it's most likely because you simply want to share a printer or a hard disk across the wire. Often the need to share files starts with the desire to enter accounting or inventory data from more than one PC. However it starts, these are basic network functions, and if your solution does not perform them well, you will never be satisfied.

But you have other features to consider as well. Naming conventions and security, for example, become important when you start allowing access to other users' systems. Other features, such as sharing CD-ROM drives and internal communications, including e-mail and network scheduling, are also increasingly popular. You'll need to keep in mind the standard delineators for NOS software: cost, performance, and scalability. Don't take this last point, scalability, for granted. Your network will, more than likely, grow—and not all of these packages scale up very well.

Among the basics, printing is critical. Examine what the NOS does for you when you print. Generally, all of the prod-



EDITORS' CHOICE

• PowerLan

The diverse and high-quality mix of products this roundup drew made it challenging for us to name just one Editors' Choice across the field. But when we compared the products taking into consideration both peer-to-peer networking basics and the potential for

growth, Performance Technology's PowerLan stood out as a good solution in any slice of this market. It addresses essentials and potential expansion equally well, all in the same package.

PowerLan only *edged* out a few of the strong competitors in this group, but it did have the best overall combination of ease of use, performance, features, functionality, and price. In particular, its intuitive Microsoft Windows interface makes installation and use enjoyable; it finished on the top rung in performance testing; it has an excellent naming scheme and security; and it includes a good e-mail package and groupware scheduling.

In addition, PowerLan excels in its support for printer sharing, still an important aspect of basic peer-to-peer networking. PowerLan was the only package to offer *class-based* printing, which allows you to set up a group of printers based on a particular set of criteria, such as PostScript or color support. Then, when you send a document to print, PowerLan sends it to the first available printer in that class and tells you where to pick up your job.

PowerLan wasn't the only product

ucts here will allow an administrator to review the status of queued jobs and to cancel jobs or move them to a higher priority. Products with strong printing capabilities, such as LANtastic, WfWG, PowerLan, and 10NET, interact with the network manager and users to report such problems as empty paper trays and jams.

Two features, *hyperprinting* and *class (group) printing*, are enhanced print services. Hyperprinting, available in InvisiLAN, LANtastic, and 10NET, is a

that caught our eye. Microsoft Windows for Workgroups is a strong peer-to-peer package, and for a shop that is 100-percent Windows, it is the best choice. It offers good performance, many well-integrated features, and a very approachable installation procedure. You must, however, buy support for DOS in a separate package—and even that is not as well-integrated as it should be. Too many sites that may want to enter networking via the peer-to-peer route have DOS-based machines, which need easy integration into whatever network is installed. At more than \$200 for the basic Windows for Workgroups package, you shouldn't have to pay \$50 more just to support your DOS machines. That support is built in to PowerLan.

Finally, we wanted to note an interesting product for users who want to share files and printers, but who are truly phobic about opening their PCs, installing cards, and setting interrupts. Coactive Connector, instead, connects through the PC's parallel port. You take a huge performance hit, but Coactive Connector offers by far the easiest installation of the lot.

feature that starts printing large print jobs before the application finishes producing all the pages.

Class printing, offered only by PowerLan, lets you group printers into classes, such as all printers with PostScript support. The printing service sends your job to the least busy printer in that class and then tells you where to pick it up.

Most of these peer-to-peer operating systems let you share CD-ROM drives, but Coactive Connector does not. This

capability was also erratic in MosesALL!. Desk to Desk, on the other hand, is particularly useful for this task.

When you create shared subdirectories on a hard disk, you give the network the ability to carry helpful network applications, such as e-mail, scheduling programs, and databases. All of the NOSs in this roundup allow you to use those applications, albeit some more slowly than others. A few packages, such as PowerLan and WfWG (and the new 6.0 version of LANtastic), are bundled with particularly good e-mail programs.

DETERMINING REAL COSTS

One of the traditional attractions of peer-to-peer networking has been relative ease of installation at a lower price. We had varying degrees of difficulty installing both the hardware and the software components of these products. In all cases but one (Coactive Connector), you must open up systems and install adapter cards. But some packages aid you with excellent setup programs—PowerLan and WfWG, for example. Others, such as 10NET, have nonintuitive installations that require countless references to the documentation.

Some of the lower-end packages bun-

■ Peer-to-Peer vs. Server-Based LANs

Which is better, peer-to-peer or client/server networking? The answer depends on your budget, your expertise, and the needs of your users.

Peer-to-Peer

- Network users can access files on other users' drives.
- Throughput degrades as network grows beyond 10 to 20 nodes.
- Some use proprietary hardware, not Ethernet, making upgrading or converting difficult.
- Installation tends to be easy, but management on a large scale may be difficult.

Server-Based

- Corporate files are centralized, reducing the possibility of file corruption.
- Throughput is usually higher, thanks to dedicated servers.
- Hardware standards make modification, upgrading, and conversion easy.
- Installation and management are complex, but management tools are sophisticated.

dle their hardware and software solutions, which makes the purchase and installation process easier but may cost you in the long run. Products like Coactive Connector, MosesALL!, and Simply LANtastic market proprietary systems that use cables and connectors that are less expensive than standard Ethernet or Token-Ring hardware. Taking hardware shortcuts or, at least, traveling on different paths, allows the companies to position their hardware at a lower price and to claim some added flexibility or simplicity

for their wiring schemes.

Although they might cost less and may be simpler than standard 10Base-T Ethernet (signaling over unshielded twisted-pair wire), nonstandard connection schemes clearly have three drawbacks. They have low throughput, as our test results show. The vendor may fold, leaving you with an unsupported orphan. And growth may be restricted, because of distance limitations and signals that can't be extended with bridges or routers. (For more information see the sidebar "Making

Suitability to Task: Peer-to-Peer Networks

Increasing productivity is generally what drives many smaller businesses to connect their systems over a network. Users want to share files, printers, and other resources easily between desktop systems. Peer-to-peer arrangements traditionally offer businesses a relatively easy way to address user productivity issues at a reasonable price. The success of these peer-to-peer packages lies in their ability to disappear into their support role while users happily share resources and communicate with each other.

File sharing is one compelling reason to connect personal computers. Pulling files from other machines is a boon to productivity. We judge file-transfer performance and file-security options, and we look at how easy it is to set up sharing arrangements. We also consider it important to have built-in support for sharing files through both DOS and Microsoft Windows.

SUITABILITY TO TASK				
Product Name	POOR	FAIR	GOOD	EXCELLENT
File sharing				
Printer sharing				
Installation and management				
E-mail and scheduling				
Scalability				

Much of **printer sharing** over a network involves making sure that the printers are on-line and available. We therefore assess the usefulness of each package's printer-error messages, including where those messages are displayed. We note the quality of printer management utilities and whether you can prioritize print jobs by user, view print queues, and delete jobs. We also note whether shared printers can produce banner pages to identify jobs.

In determining the ease of **installation and management**, we look for a good install or setup program that automatically updates the

CONFIG.SYS and AUTOEXEC.BAT in connected systems. We also note the quality of the documentation and whether a relatively nontechnical user can understand it easily. In addition, we consider connectivity options for each package (through Ethernet, parallel port, or a proprietary board), and whether hardware and cabling are bundled with the product.

Although file and printer sharing traditionally prompt management to install networks, **e-mail and scheduling** soon become very popular features to the actual users—so popular that some vendors now bundle these applications with their peer-to-peer LANs. We note whether a vendor includes e-mail or scheduling and the quality of those packages.

Finally, because networks tend to grow, we assess the **scalability** of these peer-to-peer LANs. The support of standard Ethernet architecture rather than a proprietary network is important here. We also note if the LAN can connect easily to Novell's NetWare or Microsoft Windows NT. In addition, we assess the routable protocol support (TCP/IP or IPX) and whether DOS users can share resources with Macintosh users.

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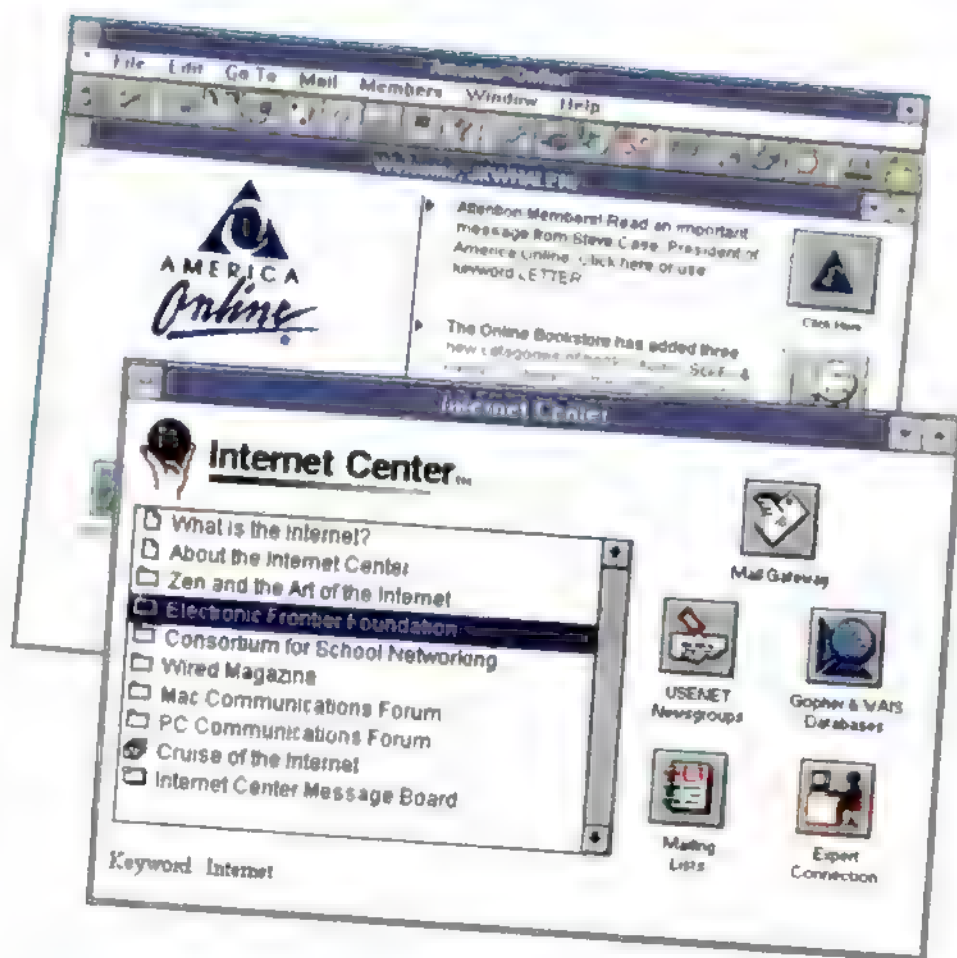
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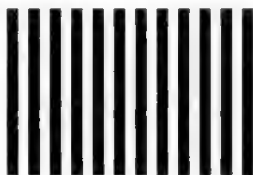


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9229/W

■ Making the Hardware Choices

By Robert P. Lipschutz

It isn't just the software you need to consider in choosing one of these peer-to-peer packages. They offer a range of solutions in the hardware they require, recommend, or bundle. Some lead you straight to an industry standard, usually Ethernet; a few take you down proprietary roads.

Some peer-to-peer packages include their own adapters and cabling. This simplifies purchase and support, but you will be tied to that vendor—for support and for price. Moreover, some proprietary adapters are slower than Ethernet: Coactive Connector and MosesALL!, for example, performed poorly in our testing. Finally, most of these solutions do not work well over distances of more than 20 feet or with computers separated by walls.

SEPARATE CHECKS

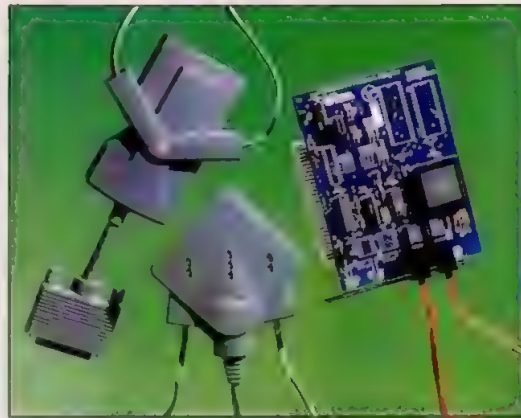
For vendors that do not include hardware and cabling, you will need to make these purchases separately. Your network adapter should be a standard Ethernet card (Token-Ring is too expensive for this market). Make sure that your peer-to-peer software supports the Ethernet vendor you choose. If the peer-to-peer software supports the ODI or NDIS protocol stacks, it will support all popular Ethernet cards.

Of course, you have to install the Ethernet cards in your systems with all the attendant concerns about hardware interrupt (IRQ) and I/O conflicts. If your PC has no other cards, you'll probably be okay with the default settings on the Ethernet card. If you have a few adapters in your PC, you'll need someone skilled at hardware installation. Also, you can get software utilities that determine available IRQs and I/O addresses.

If you have laptops you need to

network together, you have a few options. Docking stations are available for some laptops, allowing the use of standard Ethernet cards. And many excellent Ethernet adapters are available in PCMCIA format.

So we have established that Ethernet is your best choice. But there's more. You must be careful to choose



Coactive Connector, EtherWave, and MosesALL! (left to right) all use proprietary hardware. EtherWave attaches to the AUI port of any Ethernet card.

the correct connector type with your Ethernet cards—AUI, BNC, or RJ-45—according to the cable type you choose. The AUI port looks a lot like the video port on your PC, the BNC looks like your cable TV connector, and the RJ-45 is similar to your telephone jack.

Your choice of cabling depends on two factors: the location of your PCs in the office and any preexisting cabling you may have. Most Ethernet sites use unshielded twisted-pair (UTP) cable with an RJ-45 connector, under the 10BaseT specification. UTP looks very much like phone cable on the outside, but is designed for higher throughput. But 10BaseT has a hidden cost: All of the computers must connect back to a central hub in a star configuration. Consider this when you are pricing this solution. Hubs generally cost about \$60 to \$100 per port. A

10BaseT setup is a good choice if your computers are in separate offices. If your workgroup is very small and close together, you may want to explore other options.

Coaxial cable, often called thinnet, is one alternative. It uses a BNC connector and a bus topology in which computers hang off a segment of cable, and it does not require a hub. If you do not have UTP already installed at your site, coaxial cable is often more convenient for connecting computers together (note, though, that thinnet is bulky and does not hide very well). Using coaxial cable also gets trickier if the computers are in separate offices because you have to snake the cable through the walls.

So wouldn't it be great to have the best of both worlds—unobtrusive UTP cabling, but without a hub? There are some new products available that do this, and this is where the AUI connector comes into play. The AUI was traditionally used with very thick cabling, which is no longer popular.

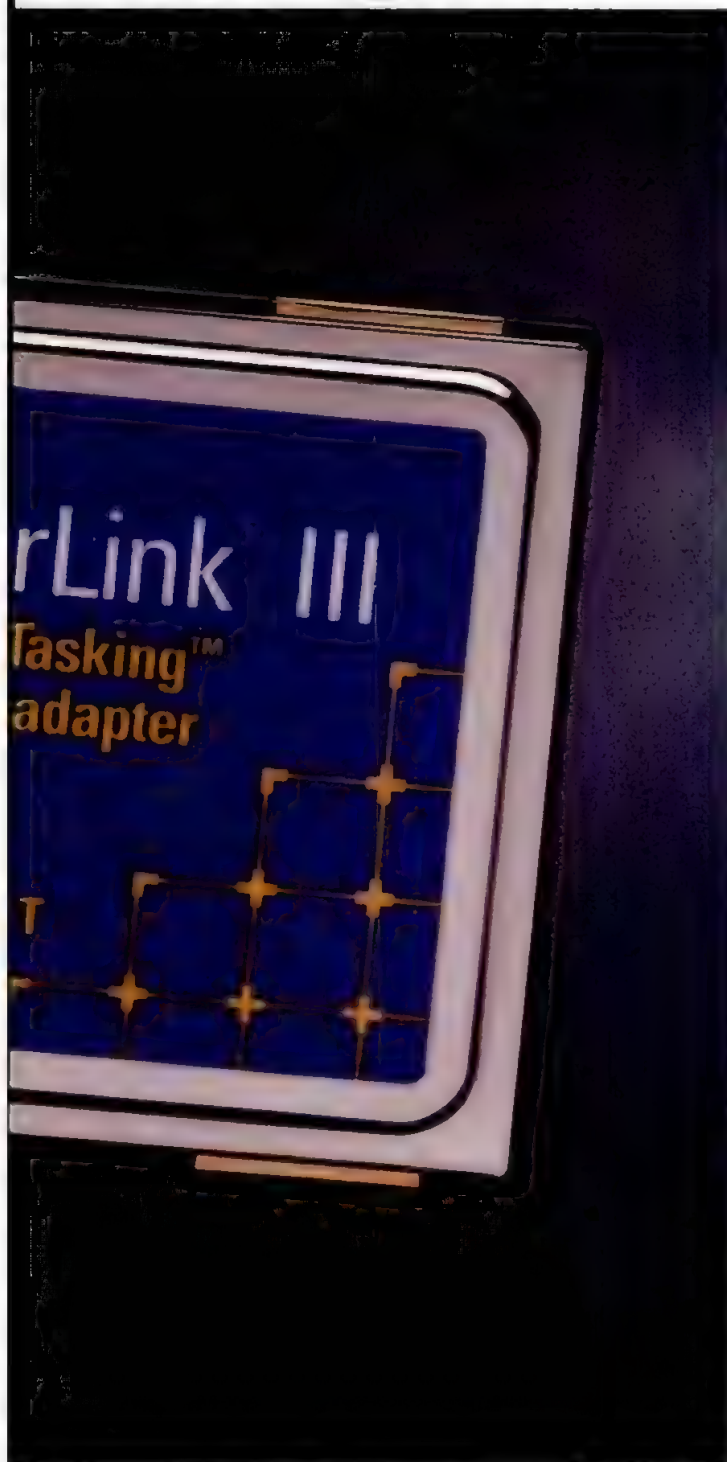
Recently, however, vendors have introduced some creative and useful products that require an AUI port. These hardware options can be used with any of the packages that support Ethernet. Farallon EtherWave, for example, attaches to the AUI port of any Ethernet card and allows you to connect computers in a daisy chain fashion using UTP, thus eliminating the need for a hub. Likewise Tut Systems' Silver Streak allows daisy-chaining using regular phone wire. So, for a price, you get the convenience of the bus topology without the unsightliness of coaxial cable.

Before you buy a complete peer-to-peer package or invest in components, you will want to examine completely the hardware and cabling requirements. □

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■ Electronic Sneakernet?

By Steve Rigney

Many sites don't need the power or want the expense of even a peer-to-peer network, but users are tired of sneakernet. Fortunately, there is a way to exchange data, share a printer, and send simple e-mail to other PC users in your company: file-transfer programs.

The major appeal of these programs is that you never have to remove the cover from your PC—most use the parallel or serial port. File-transfer programs can cost between \$40 and \$275 per PC, compared to a combined hardware and software cost of about \$200 for peer-to-peer LANs.

File-transfer programs do not allow you to share data among several users at once. They only allow you to copy a file or program from one PC to another. Many people use file-transfer programs to copy data to their laptops.

Like peer networks, file-transfer programs range in power and features. Interlnk, which is packaged with DOS 6.x, allows straight file transfers

between two PCs. Quarterdeck Office System's DESQview/X is a complete operating system with a memory manager and desktop applications. Farallon Computing's Timbuktu allows you to transfer files between PCs and between PCs and Macs. Protec Microsystem's Bytenet offers printer sharing, on-line chat, and security for your files. Most file-transfer programs offer both a DOS and Windows interface.

Some file-transfer programs, such as Timbuktu, use a simple daisy chain cable connection running from PC to PC, but one bad link takes down the whole chain. Bytenet uses a proprietary hub and serial cables to communicate between PCs. DESQview/X uses popular network protocols, such as NetBIOS and IPX, with standard adapters to transfer files.

The inexpensive price tag, ease of use, and simplicity make file-transfer applications a small but important player in the larger world of connectivity. □

the Hardware Choices"). Moreover, these solutions are not so inexpensive that you would just scrap them if they didn't grow with you. So consider carefully.

REACHING UPWARD AND OUTWARD

Your network is bound to experience some kind of addition, expansion, or growth at some point. And, although not every LAN will grow even into a medium-sized network, you should be aware of your expansion options. Adding a few nodes is one thing, but every node and every attached resource adds complexity that some of these packages are not built to handle. If you're thinking expansion, the packages at the higher end offer you the best choices in scalability.

In addition to this kind of expansion,

whether you have a network of 3 or 300 nodes, it is increasingly important to be able to extend the connections beyond the local cable. People want to link branch offices, work on the road, and work from home. Federal and local legislators are pushing plans for improved connectivity to replace commuting. But some of these NOSs reach out better than others.

Sets of standards called networking protocols determine how PCs acting in the roles of clients and servers ask for and receive services. Many of the products in this review claim to use versions of a higher-level protocol, a Microsoft standard called Server Message Block (SMB), to format queries and the Network Basic Input Output System (NetBIOS), or an extension called NetBEUI

to carry them across the network. But even when companies say they use the same networking protocols, they typically cannot interoperate and do not have the ability to use standard products like routers to extend the LAN's reach.

PowerLan, 10NET, and the beta version of Artisoft's LANtastic 6.0, however, were designed to interoperate with Microsoft Windows for Workgroups. Basically, these companies successfully cloned Microsoft's SMB and NetBEUI protocols. This interoperability means that people can use a growing field of third-party network communications products, such as DCA's RLN (Remote LAN Node) or IBM's LAN Distance to dial into the network remotely, or Message Port, from Nuko Information Systems, to share modems on the network for outgoing calls.

GAMBLE OR GROWTH

Oddly, in an industry and a market known for price competition, price might play only a minor role when you decide between these products. Your feature, interoperability, and growth requirements should override the need for the lowest dollar cost. Choosing room for growth is a safe bet; limiting your ability to expand later for a rock-bottom price now is a gamble.

Coactive Computing Corp.

Coactive Connector, Version 1.0

BY JOHN GARRIS

If all you need to do is share files and printers between a couple of PCs or Macs, Coactive Connector, Version 1.0, is by far the easiest solution. That's because you never have to open your PCs to connect them: Its adapters connect through the parallel ports. But this method is subject

SUITABILITY TO TASK

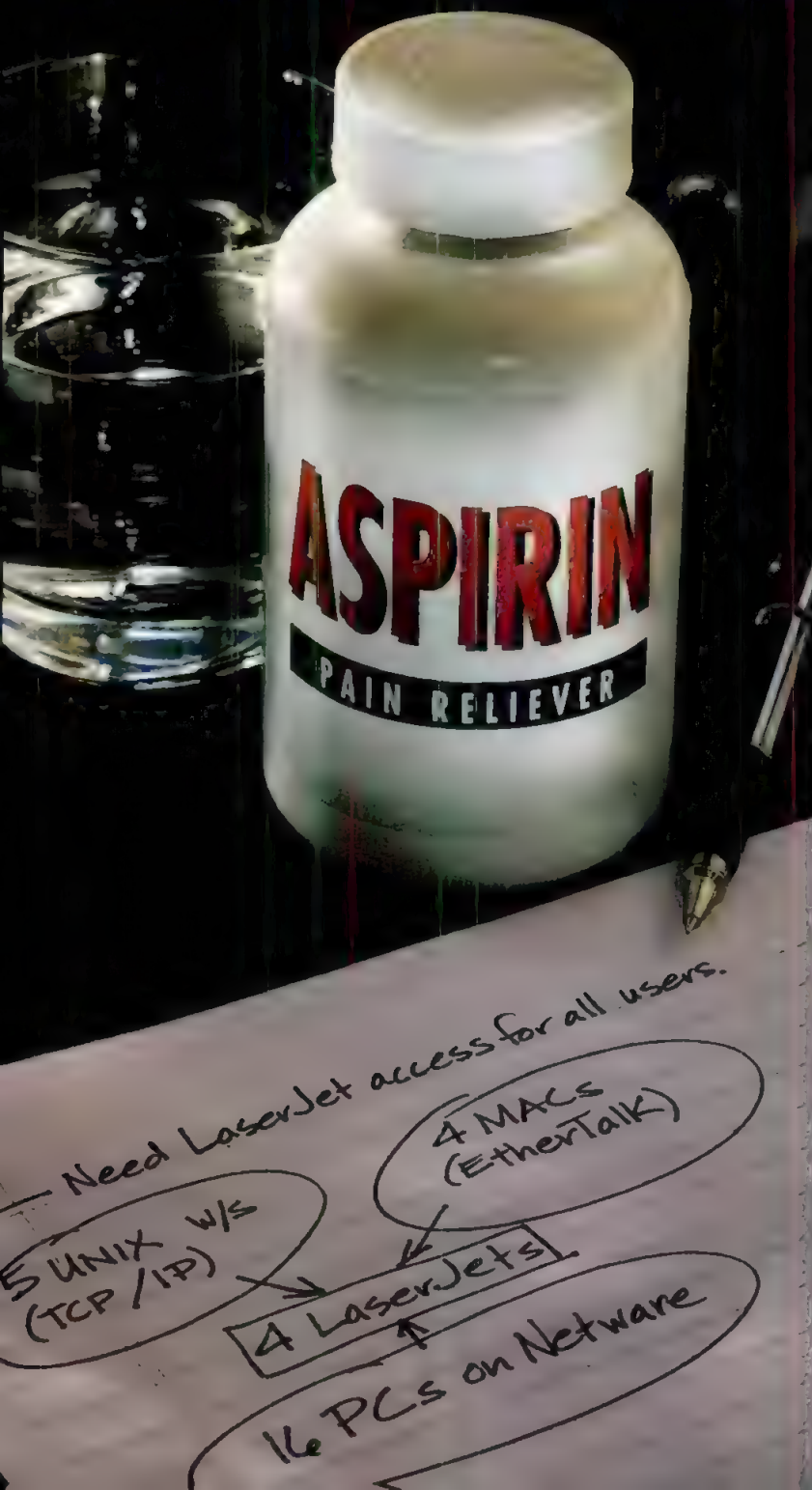
Coactive Connector

	POOR	FAIR	GOOD	EXCELLENT
File sharing	☒	☒	☐	☐
Printer sharing	☒	☒	☐	☐
Installation and management	☒	☒	☒	☒
E-mail and scheduling	☒	☐	☐	☐
Scalability	☒	☒	☐	☐

Our Contributors: FRANK J. DERFLER, JR., is senior networking editor of *PC Magazine*. STEVE RIGNEY is a network consultant and a frequent contributor to *PC Magazine*. JOHN GARRIS is a technical analyst for *PC Magazine*. CHUL SUNG KIM is a technical specialist at ZD Labs. GAIL SHAFFER was the associate editor in charge of this story, and ROBERT P. LIPSCHUTZ was the project leader.

Pacific DirectNet.

It takes the pain out of sharing LaserJet printers on a network.



What a relief. At last there's a network print server card that eases the pain associated with managing networked printers.

It's called Pacific DirectNet. And painlessly, it connects HP® printers and plotters to virtually any Ethernet or Token Ring network, while simultaneously supporting Novell NetWare, UNIX TCP/IP and EtherTalk operating systems.



Pacific DirectNet is engineered to simplify the entire printer sharing process, from installation to everyday use. Software is included that allows automatic setup on Novell networks. And with support for LPR/LPD, FTP, TFTP, and RShell, it's easy to setup and connect printers to any UNIX network—Sun, HP, IBM, DEC, SCO, Solaris, and Interactive UNIX.

For network managers, upgrading to the latest network operating system or to new features of an existing one is surprisingly simple. Just slip a disk into a PC and update Pacific DirectNet's Flash memory. There's even an SNMP agent that allows network management software to recognize and manage printers just like it does other network devices.

With Pacific DirectNet, sharing a networked printer is no longer a headache for users either. Because with automatic switching between operating systems, they won't be troubled by frequent trips to the printer front panel to switch protocols.

Pacific DirectNet boards are available for HP LaserJet® III, IIId, IIISi, 4, 4M, 4Si, 4Si MX, PaintJet® XL300, DeskJet® 1200C, and DesignJet® printers and plotters. For more information, a dealer near you, or to order direct from Pacific Data Products, call us today at (619) 625-3676.



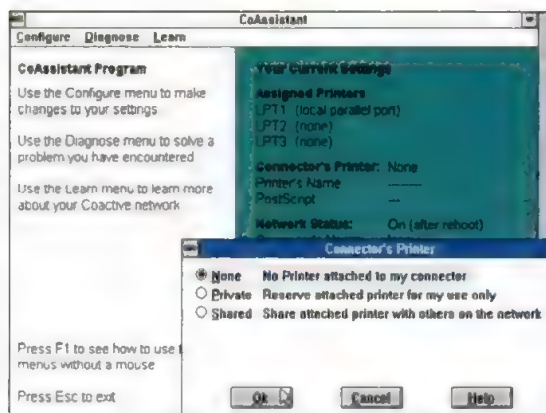
PACIFIC DATA
PRODUCTS

to the 230.4-Kbps bandwidth limitation of the LocalTalk protocol it uses. Nor does Coactive Connector provide a real security scheme. It also costs a lot more than rival MosesALL!, but Coactive Connector is very easy to use.

Installation was a breeze. After "installing" the hardware—no opening the case and no playing with DIP switches or interrupt settings—you simply run an install program on each PC. You give each system a name, name any attached printer, and indicate whether it supports PostScript. Then you plug the telephone-like cable into each computer, and you've got a Coactive network.

That may be where the benefits end for many. Coactive Connector does not let you share an entire hard disk with others, only a directory called \SHARED. It sets up a virtual network drive (usually N:), on each machine, which displays all the \SHARED directories. Every user has full access to those directories, and write-only access to a \SHARED\PRIVATE subdirectory. But there are no other security provisions whatsoever: Anything you have in \SHARED is fully accessible to all.

You can connect Macs to the network, but they must be configured to provide



The CoAssistant program that comes with Coactive Connector lets you configure printers and other network resources using a Windows interface.

guest access, and then only the SHARED folder is accessible to other users. Configuration is quick and simple.

Coactive Connector costs \$399.95 for a two-node Starter Kit, including hardware, but it took more than 16 minutes to transfer one 5MB file. If you're phobic about opening machines and you think you can stand the performance hit, this is a great product. But look elsewhere if you plan to do more than transfer files and share printers.

CBIS Inc.

Desk to Desk, Version 2.0

BY STEVE RIGNEY

Priced at the low end, Desk to Desk, Version 2.0, offers an interesting choice between more powerful products, such as LANtastic, and simpler packages, such as MosesALL! or Coactive Connector. At \$129 for up to 255 users the price is right—perhaps the lowest price per node in this field. But that's only for basic sharing of files, printers, and CD-ROMs. Its performance was acceptable, but its Windows interface

is not as robust as some, and it does not include e-mail or scheduling.

The version of Desk to Desk we tested did not include an automatic Windows

FACT FILE

Desk to Desk, Version 2.0

*CBIS Inc., 5875 Peachtree Industrial Blvd.,
Norcross, GA 30092; 800-835-3375,
404-446-1332; fax, 404-446-9164*

List price: Software only: \$129 (supports 2 to 255 users).

Requirements: 50K RAM (server, peer), 23K RAM (client), 2MB hard disk space, DOS 3.1 or later.

In Short: If you have to grab the lowest starting price, but you still need acceptable peer-to-peer potential, check out CBIS's Desk to Desk. Its price—\$129 for up to 255 users—includes file, printer, and CD-ROM sharing in addition to network security and a chat feature. While some of the other products here offer more powerful, intuitive Windows interfaces and better performance, Desk to Desk offers some high-end features for its low price.

ON READER SERVICE CARD

setup program, so we had to install and set up the network drivers manually. (During review, CBIS said it was working on a better setup and manual, but neither was available in time for testing. They may be ready by the time you read this.)

Desk to Desk included just a two-page installation sheet; the rest of the documentation is on-line in a nonintuitive DOS-based program. A novice user would have a hard time installing the product, solving problems, and learning new features. But once the package is installed, you can easily share your attached hard disks, printers, and CD-ROMs with other users on the network.

Even though the Windows interface is not as robust as that of other products,

such as PowerLan or WfWG, it does allow you to share your resources readily; moreover, it's a lot better than the DOS interface. For network printing, Desk to Desk includes a print queue, and you can add banners, form

feeds, and trailers to your jobs.

Desk to Desk performed acceptably on our tests, easily outpacing lower-end products such as MosesALL!. And CBIS offers

FACT FILE

Coactive Connector, Version 1.0

*Coactive Computing Corp., 1301 Shoreway
Rd., #221, Belmont, CA 94002;
415-802-1080; fax, 415-593-9304*

List price: Two-node Starter Kit, \$399.95; each additional node, \$199.95.

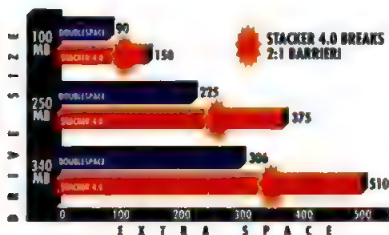
Requirements: 1.5MB hard disk space, DOS 3.1, 3.3, or higher.

In short: Coactive Connector is an extremely simple, easy-to-use product meant for people who want basic file- and print-sharing services without having to know very much about computers. You don't even need to open the PC's system unit: The proprietary adapters connect through the parallel port. But it is by far the slowest product in this roundup, it provides no security options, and you can only share certain parts of your hard disk with others.

ON READER SERVICE CARD

SUITABILITY TO TASK				
Desk to Desk				
	POOR	FAIR	GOOD	EXCELLENT
File sharing	●	●	○	○
Printer sharing	●	●	○	○
Installation and management	●	●	○	○
E-mail and scheduling	●	○	○	○
Scalability	●	●	●	○

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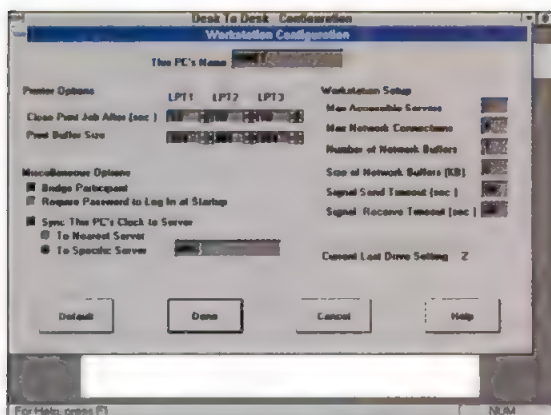
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Desk to Desk allows you to configure parameters such as network and print buffers for all of your client PCs.

a separate 32-bit dedicated server package called Powerserve for another \$399.

Network security is handled with a password system through which you can grant create-file, read-only, and read/write access. In a manner similar to the one used by Windows for Workgroups, Desk to Desk allows you to password-protect individual resources such as a sub-directory. It does not allow user-defined network groups like "marketing" or "sales," so you cannot simply assign privileges to a group. You must set them up on a person-by-person basis.

Like PowerLan and LANtastic, Desk to Desk uses Microsoft's SMB, so you can connect to a Windows for Workgroups or Windows NT server from any client. It also supports NetBIOS and IPXODI.

If price is your principal or only consideration, it's hard to beat Desk to Desk—even against some of the simpler packages here. Yet its performance, its Windows integration, and its feature set do not quite bring it up to some of the better packages in this roundup.

Invisible Software Inc.

InvisibleLAN, Version 3.44

BY STEVE RIGNEY

A solid peer-to-peer network, InvisibleLAN, Version 3.44, delivers good performance, excellent security, and expansion capabilities. It also offers basic, though limited, e-mail. A few of the high-end packages in this roundup offer more powerful e-mail and scheduling.

Designed for small to medium-sized

networks, Invisible Software's product finished near the top in our performance tests. Its 32-bit protected-mode server, called Ultra Server, also offers a performance edge over nonprotected-mode server versions, such as those from CBIS and Performance Technology.

InvisibleLAN shares the honors with LANtastic for the best network security here. It allows you to password-protect both servers and individual network resources, such as directories or specific files.

You can set up such privileges as create, execute, list, and write for all the files and directories on your server. LANtastic, by comparison, does not allow you to password-protect individual directories or files.

InvisibleLAN's e-mail lets you send text messages to other users. You cannot, however, attach binary files, send "carbon copies," or forward messages.

Installation was somewhat more bothersome than necessary. For one thing, we had to install the Windows network driver manually. And InvisibleLAN does not automatically pop up its own Windows icon when you install. You must do that manually. In addition, although this package does have a Windows interface, it is a weak one. It is not intuitive, and many processes are less automatic than they should be.

InvisibleLAN does offer some choice in hardware. It can use standard Ethernet cards, and Invisible Software also sells its own adapters, the NodeBlaster line. It includes a version for thin Ethernet, which emulates an NE2000, and the NodeBlaster Plus, which emulates a Western Digital WD8013 and provides connections for 10Base2, 10Base5, or 10BaseT cabling.

The package's network printing capabilities are acceptable, but not the best. InvisibleLAN provides a network print queue, but does not allow you to monitor the printer automatically from a client PC. You can use a separate remote management module to view print jobs, delete them, and so on. And unlike other products, such as PowerLan and LANtastic, the network does not alert you if the

printer is off-line or out of paper. If there is a problem with the network printer, the software issues only a DOS or Windows system error.

InvisibleLAN uses the NetBIOS network protocol and also provides NDIS drivers, so you can load the networking software needed to connect to other networks such as NetWare. InvisibleLAN

SUITABILITY TO TASK

InvisibleLAN

	POOR	FAIR	GOOD	EXCELLENT
File sharing	●	●	●	○
Printer sharing	●	●	○	○
Installation and management	●	●	○	○
E-mail and scheduling	●	●	○	○
Scalability	●	●	●	○

also connects to Windows for Workgroups 3.1 but is not compatible with WfWG 3.11. (Invisible says it's working to resolve this.)

Reasonably priced, InvisibleLAN is offered as DOS/Windows software for \$579 in a five-user package and as a software and hardware package starting at \$449 for the program and two network adapters. The 32-bit Ultra Server dedicated server is \$399 per site license.

Invisible LAN has good performance and security, but it lacks good e-mail and scheduling, and its Windows interface and network printing are weak. If, however,

FACT FILE

InvisibleLAN, Version 3.44

*Invisible Software Inc., 1115 N. Hwy. 427,
#135, Longwood, FL 32750; 800-982-2962;
407-260-5200; fax, 407-260-1841*

List price: Two-user starter kit, \$449; five users (software only), \$579; Ultra Server, \$399

Requirements: 45K to 90K RAM (server), 65K to 110K RAM (peer), 55K to 90K RAM (client), 2.5MB hard disk space, DOS 3.1 or later.

In Short: InvisibleLAN's powerful, 32-bit dedicated file server delivers excellent performance. It provides good network security in both the DOS and Windows environments, but its print-management capabilities need some work to reach the level of some other high-end packages. It does, however, provide good expansion opportunities and a basic e-mail package.

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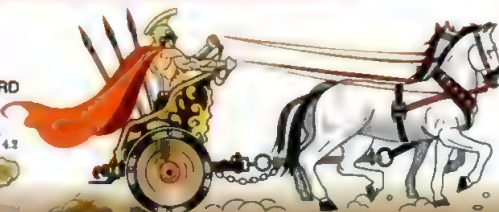
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Benchmark Tests: Peer-to-Peer Networks

What the Numbers Mean

There are two main performance issues with peer-to-peer networks: how long it takes to get a file from a server, and how much a local user notices when someone else is accessing the local system. In the first area we found that some packages were surprisingly fast, while others were orders of magnitude slower. Microsoft Windows for Workgroups (WfWG), for example, performed reads almost twice as fast when 32-bit disk and file access was turned on—although when it was off WfWG still performed as well as any other package in our roundup.

On the other end of the spectrum, MosesALL! was very slow and Coactive Connector was many times slower than MosesALL!. MosesALL! uses a proprietary protocol to transmit data and runs at slightly under 4 megabytes per second. Coactive uses AppleTalk protocols and bundles adapter devices that connect through the PC's parallel port, greatly compromising performance. All the other products ran over Ethernet, and the differences among those products were minimal compared with the differences between Ethernet and non-Ethernet products.

A cache had little effect (less than 10 percent) on most peer-to-peer dedicated servers, with the exception of InvisibleLAN, WfWG, and Personal NetWare. InvisibleLAN's dedicated server uses a cache quite effectively, WfWG uses a 32-bit cache that replaces SMARTDRV, and Personal NetWare uses a special cache, NWCACHE, instead of SMARTDRV. (SMARTDRV will not allow you to cache network reads, so software vendors that rely on it for their servers do not benefit from caching.)

Configuring a dedicated server, however, significantly boosted transfer times for several peer-to-peer LANs, including LANLink Professional, LANstep, and LANtastic. Writes to the server benefited the most from optimization; on some of the packages the server keeps the data in its cache and writes it out to disk only during idle states or just before it goes down. The more basic packages, however, do not have any optimization settings.

You can look at the Read with Disk-Intensive Foreground Traffic (nondedicated server) and the Spreadsheet Recalculation results together to show how many CPU cycles the peer-to-peer gives to network requests versus local requests. In those tests, some of the products, such as LANtastic and MosesALL!, would not even start the network copy until the local file transfer was done. These same products show relatively better ratios because all resources are given to the local file transfer and not the network transfer. Most products balance the load between network and local tasks.

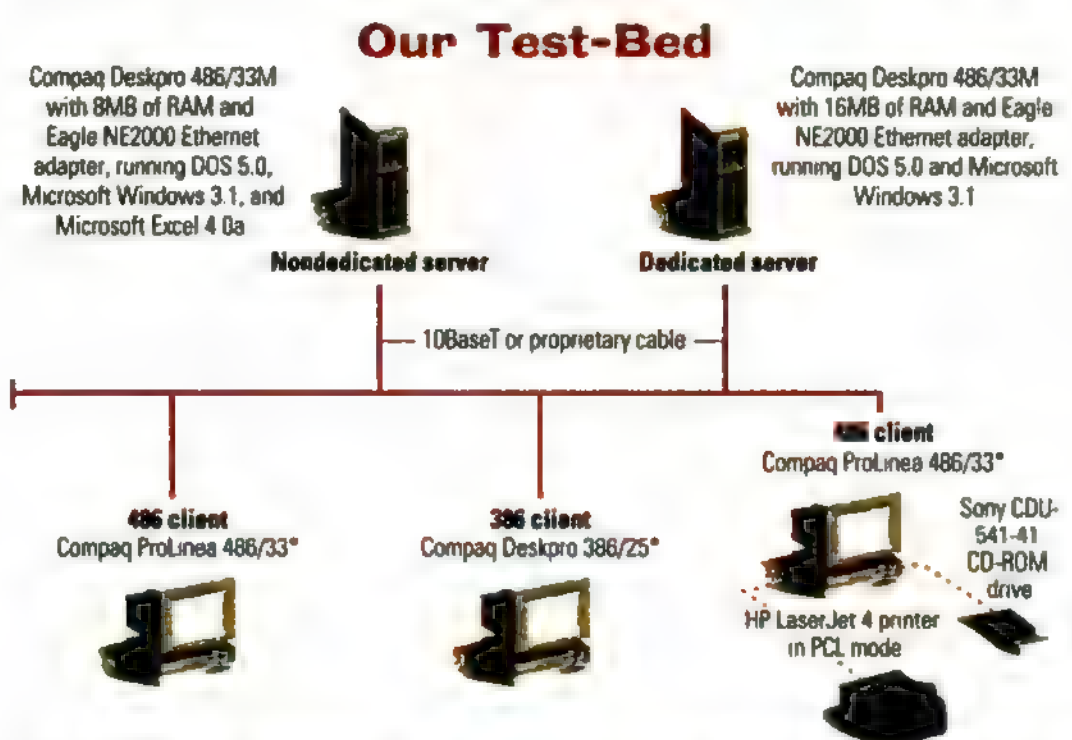
The Spreadsheet Recalculation and Local File Copy tests show how much of an effect the user might sense when a remote user is transferring files to and from his hard disk. With some products, especially 10NET LAN Operating System and LANLink Professional, the effect is negligible. With a package like Desk to Desk or PowerLan, however, you may spend time wondering who is responsible for making your new 486/50 feel like an old 286.

How We Tested

Traditionally, peer-to-peer LANs have stood out more for their ease of use and economy than their performance. With the range of products we drew here—some of which tout performance—we decided to test it from several different angles. We set up five systems on our peer-to-peer test-bed. We tested the software on a nondedicated server and then on a dedicated server. We also configured two client/server systems using Compaq ProLinea 486/33s with 4MB of RAM each, and a client-only machine using a Compaq Deskpro 386/25 with 4MB of RAM. When possible, we used Eagle NE2000 Ethernet adapters; we used a vendor's proprietary adapters when we had no other choice.

We installed the peer-to-peer software using default configurations for all systems except the dedicated server. For that machine we used vendor-supplied tuning parameters to optimize performance. The one exception was WfWG. WfWG's default is to disable 32-bit access because of compatibility problems with disk-compression software, SCSI hard disks, and portable computers with sleep modes. We enabled the 32-bit disk and file access, but you should be aware of these problems. All other client systems should enable 32-bit disk and file access, so we did that as well. We also ran tests using the WfWG default 16-bit settings.

We used the Windows 3.1 File Manager to perform all our disk operations. Windows introduces some overhead, but most sites will use Windows more often than



* With 4MB of RAM and Eagle NE2000 Ethernet adapter, running DOS 5.0, Microsoft Windows 3.1, and Microsoft Excel 4.0a.

DOS and will be more concerned with Windows performance. For all our CPU-intensive tasks, we performed a lengthy spreadsheet recalculation using Microsoft Excel 4.0.

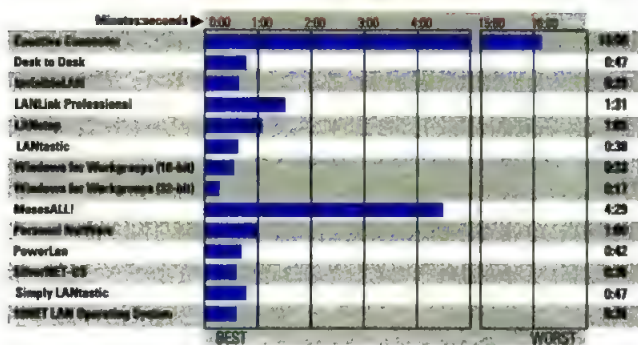
We performed all tests using the Deskpro 386/25 client and either the nondedicated or dedicated server. Although simultaneous access from multiple clients is possible on a peer-to-peer network, we decided that a one-to-one connection would be much more common. The four tests of **Nondedicated Server Hard-Disk Transfers** measure the time to read or write a 5MB file using the nondedicated server and our 386 client. We performed various foreground tasks on the server to observe the effect on file-transfer times. The three tests of **Dedicated Server Hard-Disk Transfers** measure the time to read or write a 5MB file using a dedicated server. We measured the read times first with the file on the server's hard disk and then on a second-pass read when the file would potentially be in cache.

The **Effect on Local Machine** ratios measure the effect that a local user notices when there is continuous disk traffic from the local hard disk to a remote hard disk. On the local system we chose both a CPU-intensive task—an Excel spreadsheet recalculation—and a disk-intensive task—the local copying of a file—as foreground processes and measured the slowdown that occurred during each file transfer.

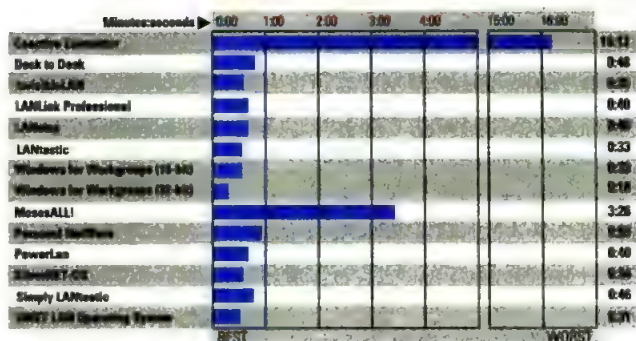
—Analysis by Robert P. Lipschutz

FILE SHARING

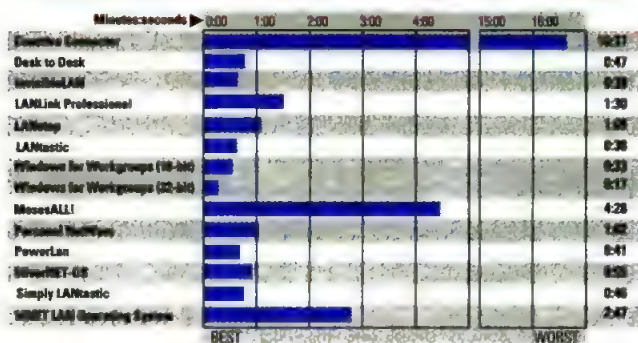
Read with No Foreground Task



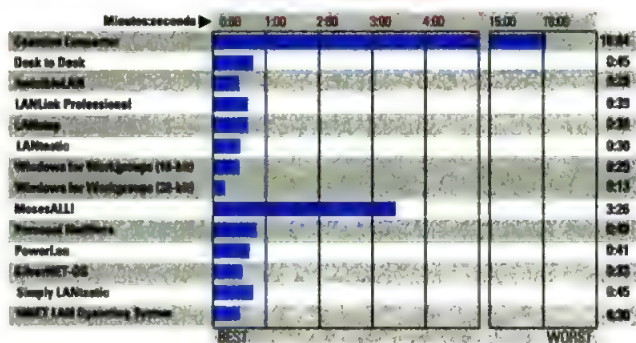
Read from Server



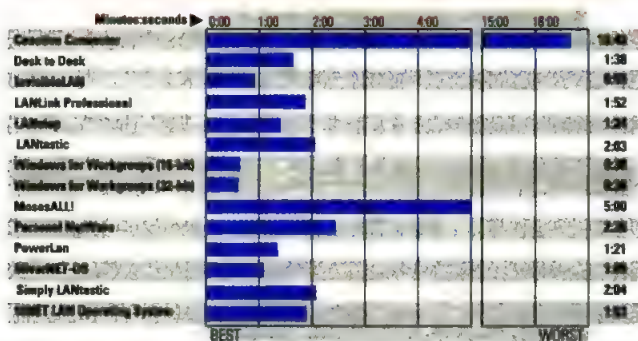
Read with CPU-Intensive Foreground Traffic



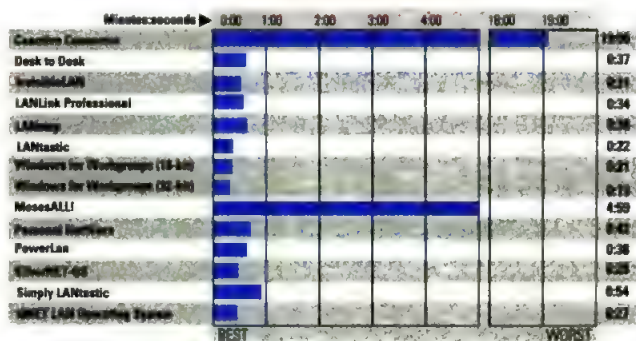
Second-Pass Read



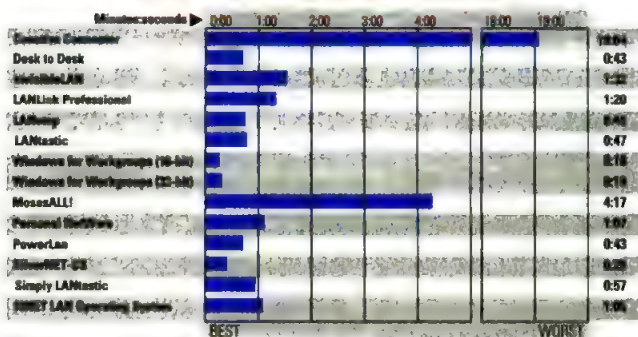
Read with Disk-Intensive Foreground Traffic



Write to Server



Write with No Foreground Task



EFFECT ON LOCAL MACHINE

Ratio of time with background traffic/
time with no background traffic

Product	Ratio	Ratio
Executive Commander	1.3	1.0
Desk to Desk	1.7	2.0
InstallableLAN	1.6	1.0
LANLink Professional	1.2	1.1
LANtastic	1.5	1.2
LANtastic	1.5	1.0
Windows for Workgroups (16-bit)	1.4	1.5
Windows for Workgroups (32-bit)	1.4	1.5
MosesALLI	1.4	1.0
Personal Software	1.8	1.6
PowerLan	1.5	2.0
SilverNET-OS	1.2	1.3
Simply LANtastic	1.8	1.0
SMART LAN Operating System	1.1	1.0

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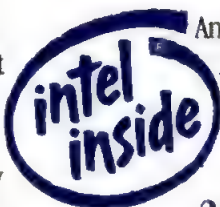
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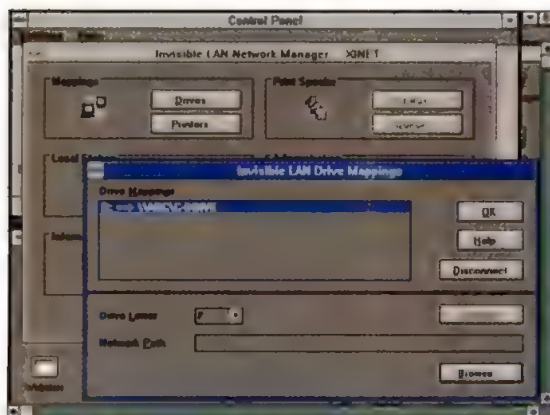
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CIRCLE 144 ON READER SERVICE CARD



InvisibleLAN offers a basic Windows interface for making connections to your network resources.

these things are acceptable, and you want a product that will allow you to grow without losing performance, InvisibleLAN and Ultra Server offer a robust solution.

Robertson-Carusio & Associates Inc.

LANLink Professional, Version 1.02

BY STEVE RIGNEY

At about \$99 per node, LANLink Professional's price is in the ballpark with those of the higher-end products, but its performance and features are more in line with the lower end. Version 1.02 offers network printing and basic security but

DOS box under Windows. You can also use a special supplied multitasking utility called TinyTask, but that forces you to dedicate a DOS application to the job.

LANLink uses NetBIOS and works with most network adapters. But most appealing is its ability to use parallel, serial, and Ethernet connections simultaneously. And, like most products in this roundup, it cannot connect you to Macintoshes. LANLink offers both username and password security, but does not include any file- or directory-level protection. It provides more features and better performance if you are running the \$195 per-user-or-more PC-MOS—a 12-year-old multitasking operating system developed by Robertson-Carusio & Associates.

On our performance tests, LANLink scored near the bottom. The dedicated server program did increase throughput, but not enough to merit dedicating a PC as a server. If you want to use parallel, ser-

has no e-mail, scheduling, nor any menu structure. It is, however, one of the few products here that allows serial and parallel connections in addition to Ethernet.

LANLink requires you to use a command line interface to perform tasks, such as connecting to a network server or redirecting your printer port, which is potentially a rough spot for novices.

The package includes both a dedicated and nondedicated server program, but you must run the nondedicated server in a

SUITABILITY TO TASK				
LANLink Professional				
	POOR	FAIR	GOOD	EXCELLENT
File sharing	☒	☐	☐	☐
Printer sharing	☒	☐	☐	☐
Installation and management	☒	☐	☐	☐
E-mail and scheduling	☒	☐	☐	☐
Scalability	☒	☐	☐	☐

ial, and Ethernet connections on one LAN, you will want to consider LANLink. But other products offer better performance and features at a lower price.

Hayes Microcomputer Products Inc.

LANstep, Version 2.0

BY JOHN GARRIS

Boasting one of the fastest file-transfer rates in our testing and good security and management, LANstep, Version 2.0, is hindered somewhat by poor Windows integration and heavy memory requirements. Also, because it is a full-fledged operating environment with a proprietary file system, it is more complicated than most packages here. (Windows applications that require 386 enhanced mode will not work on a LANstep server, for instance.)

LANstep's test results were only slightly slower than those of the leaders. And its management features are among its strongest assets. Much like Personal NetWare, user accounts and access rights are managed at a single location, although the administrator can view print queues and gather diagnostic information from any PC on the network.

Installation was lengthy but straightforward, although the proprietary file system may complicate matters for some users. You are required to reserve a portion of the hard disk for data that you want to share (although you do not need to repartition the drive to do so), and you must copy existing DOS-based files there before other systems can see them.

Memory is also a consideration with LANstep. If you are configuring a server, you need

FACT FILE

LANLink Professional, Version 1.02

Robertson-Carusio & Associates Inc., 4514 Chamblee-Dunwoody Rd., #342, Atlanta, GA 30338; 404-512-0600; fax, 404-263-6474

List price: Single node, \$99, five-user version, \$495

Requirements: 386-based PC or better (server, peer), 286-based PC or better (client), 32K RAM (server, client), 64K RAM (peer), 1MB hard disk space, DOS 5.0 or later

In Short: A slow performer without a good DOS or Windows interface—only command-line syntax—LANLink is priced high to be considered lower-end, but it doesn't carry the level of features or functionality of the higher-end products here. Its most appealing feature is the ability to connect your PCs using parallel, serial, and Ethernet connections on the same LAN

LANLink Professional Server Status Screen					The Software LYNX Net 1.02	
Satellite	I/O Count	Open Handles	Open FCBs	Critical Err		
1 JOESAT	26420					
2 WINSAT	25610	0				
3 JINSAT2	28227					
4 PAULSAT	14720	3				
9 JIKSAT	9631					
8 BETTYSAT	22507	2		5		
7 PENNYSAT	4137					
6 TECHSAT	2941					
0						
30						
31						
32						
33						
34						
35						
36						
Drives C						
Printers	LPT1-2	Server Memo	MARKETING			
I/O count	122483	Retries	4 FCBs	0 Handles	5	
30 30 30 42 3f 3e 4e c	30 3f 3f 4e 3f 3f 3f 3f 4e 3f 3f 30 30 3c 40					
3e 30 42 40 42 40 42 42 3f 3f 40 42 3f 40 42 40 42 40 42 42 3e						

There is no graphical interface for LANLink Professional. Instead, you work strictly from the DOS command line.

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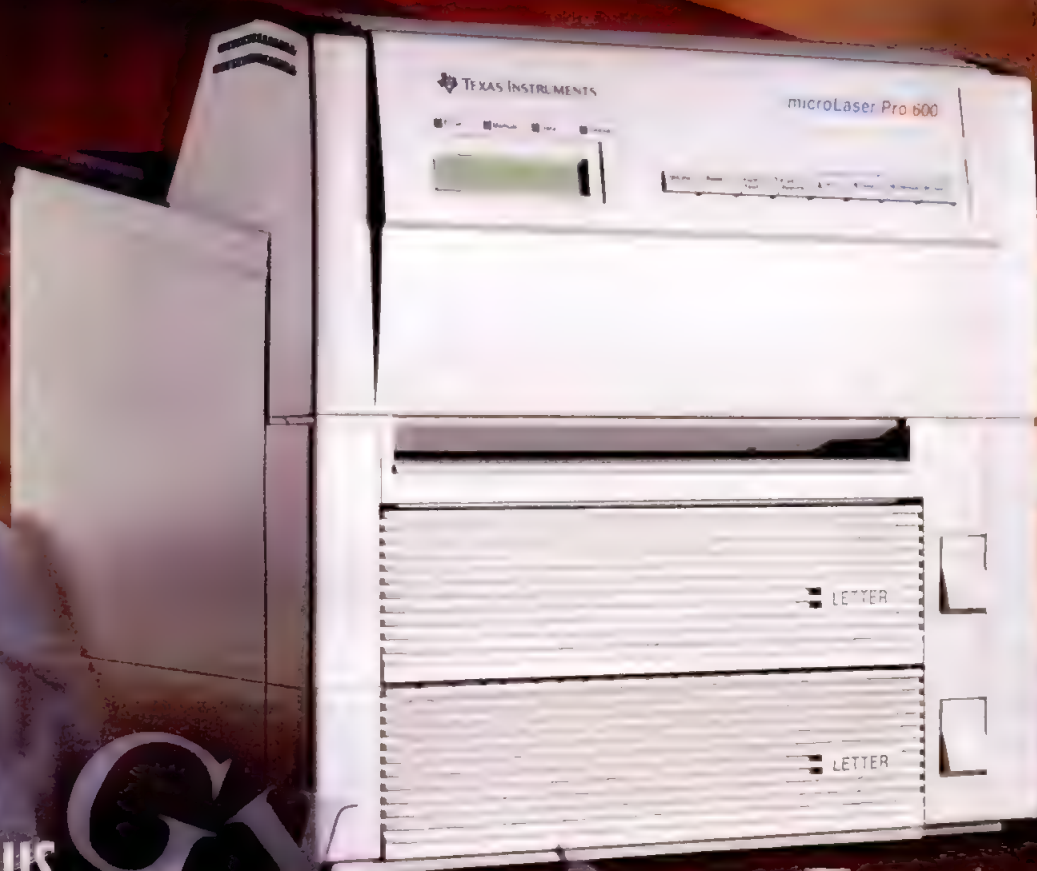
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	TI microLaser Pro 600	HP LaserJet® 4	HP LaserJet 4M
True 600 dpi	Yes	Yes	Yes
Memory	6MB	2MB	6MB
Emulations	PCL5/Adobe® PostScript® 2	PCL5E	PCL5E/Adobe PostScript 2
Compatibility	DOS/Mac	DOS	DOS/Mac
Toner Cart. Life	15K pages*	6K pages	6K pages
Paper Trays	250 sheet/250 sheet	250 sheet/100 sheet	250 sheet/100 sheet
Auto Language Switching	Yes	No	Yes
Auto Interface Switching	Yes	Yes	Yes
40MHz Processor Upgrade	Optional	Not Avail.	Not Avail.
List Price	\$1599*	\$1839	\$2479

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INSTRUMENTS**
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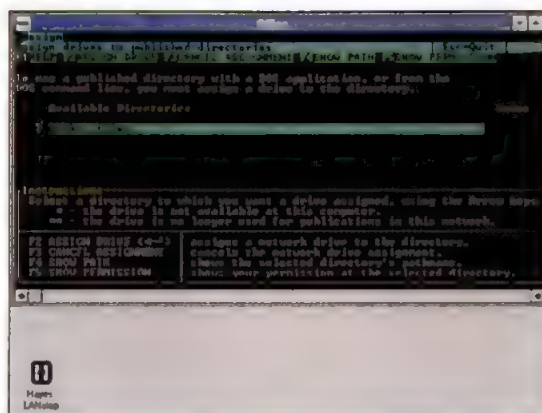
SUITABILITY TO TASK

LANstep

	POOR	FAIR	GOOD	EXCELLENT
File sharing	●	●	○	○
Printer sharing	●	●	○	○
Installation and management	●	●	○	○
E-mail and scheduling	●	●	○	○
Scalability	●	○	○	○

at least 1.5MB of extended memory—far more than any of the other packages in this roundup require. Furthermore, if you use Windows you have to specify in a configuration file how much of your extended memory goes either to LANstep or to Windows. If you change your mind later, you have to reboot the machine to put your changes into effect.

Among the appealing features in this product, users can run DOS applications or the included e-mail facility without maneuvering through DOS directories, and all accessible resources are immediately available from within LANstep. But although this setup makes access to networked resources more transparent to users, it also requires more overhead on the part of the network administrator. DOS applications may have to be tweaked for LANstep. If you plan to run Windows you need to edit configuration files after the installation procedure to



A combination menu and command-line interface helps you use LANstep—but some users may find the operating system more complicated than necessary.

allow Windows access from LANstep.

To its credit, the interface is fairly easy to use. Although text-based, the icons make it easy to perform regular tasks, and you can use a mouse. If you have grown accustomed to DOS, however, you may find it strange to use the LANstep interface to maneuver through the network and execute applications. It is also not as attractive nor as flexible as a graphical interface.

LANstep offers some nice features, but it is a mixed bag—more complicated to use than most packages here and requiring a lot of memory. And if you're running Windows, be prepared for problems.

Artisoft Inc.

LANtastic, Version 5.0

BY STEVE RIGNEY

Whether you run a small office or a large organization, Artisoft's LANtastic, Version 5.0, is a good choice. It has good interfaces for both DOS and Windows, capable e-mail, strong security and print management, and good performance. It includes NDIS drivers for most major interface cards, and add-ins are available to connect to NetWare, TCP/IP networks, and Macintosh computers.

Both a DOS and Windows interface are available to access network resources, send e-mail, and perform maintenance and security tasks. Al-

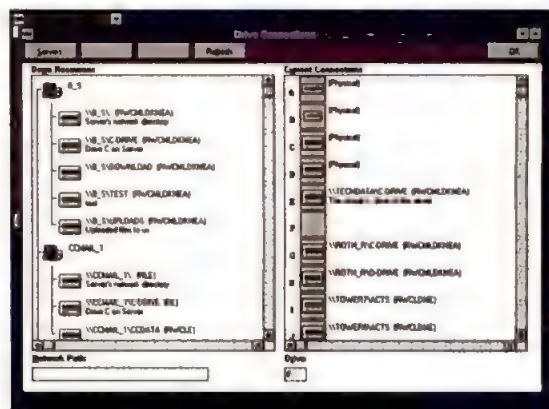
though the Windows interface is not as engaging as PowerLan's, it is easy to use, and the manuals explain every detail. You connect to a network resource simply by highlighting your local drive or port and clicking on the desired resource.

LANtastic's security is among the best in this field. You can use the Net Manager program to create accounts, passwords, groups, and Access Control Lists (ACL). ACLs allow you to assign and change access rights for entire groups of users. Or you can assign specific

rights to directories or individual files, such as create, list, modify, read, and write, as well as time-of-day and duration limits. LANtastic also includes a network audit utility you can use to keep track of network access by individual users or groups.

LANtastic 5.0's e-mail is not as powerful as Windows for Workgroups' Microsoft Mail and does not allow you to send multiple attachments. There are no shared mail folders and only a basic text editor. But these are among many features that are improved in LANtastic, Version 6.0 (see the sidebar "Artisoft Ups the Ante" for more information).

LANtastic, like 10NET, offers some top-notch printing features. Both products support hyperprinting, which streams print jobs to the printer before the application has finished building the entire job—ideal if you print large jobs such as spreadsheets and graphics.



LANtastic 5.0's Windows interface makes it easy to connect to network resources such as hard disks and printers.

FACT FILE

LANstep, Version 2.0

Hayes Microcomputer Products Inc., 5835 Peachtree Corners East, Norcross, GA 30092; 800-964-2937; fax, 404-441-1213

List Price: Up to 5 concurrent users, \$595

Requirements: 286-based PC or better (server and peer), 50K conventional memory and 1 MB extended memory (server and peer), 9K to 120K RAM (client), 1MB hard disk space (server, peer), 20MB hard disk space (primary file server), 250K hard disk space (client), DOS 3.3 or later, Microsoft Windows 3.1

In short: Good performance, security, and management recommend Hayes LANstep, but it lacks good Windows integration, and it uses a lot of memory. And because it is a complete operating system, LANstep has a steeper learning curve than other packages here

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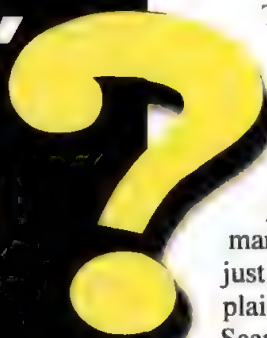
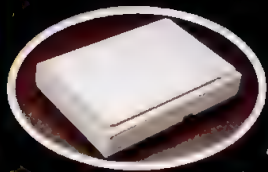
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► **S U M M A R Y O F F E A T U R E S**

Peer-to-Peer Networks

Products listed in alphabetical order

■ = YES □ = NO

	Coactive Computing Corp. Coactive Connector, Version 1.0	CBIS Inc. Desk to Desk, Version 2.0	Invisible Software Inc. InvisibleLAN, Version 3.44	Robertson-Caruso & Associates Inc. LANLink Professional, Version 1.02	Hayes Microcomputer Products Inc. LANstep, Version 2.0	Artisoft Inc. LANtastic, Version 5.0	Microsoft Corp. Microsoft Windows for Workgroups, Version 3.11
List price (tested configuration)	\$999.75	\$129.00	\$978.00	\$495.00	\$595.00	\$595.00	\$349.75
Maximum number of nodes supported	32 (suggested)	255	255	255	255	Unlimited	Unlimited
Network Hardware Supported							
NE2000/WD8003/3Com Etherlink III cards	N/A*	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■
Parallel/serial port	■ □	□ □	■ □	■ ■	□ □	■ ■	■ ■
Proprietary or standard adapter	Proprietary	Standard	Standard	Standard	Standard	Either	Standard
Flat telephone wire/Unshielded twisted-pair cable	■ ■ ■ ■	■ ■	□ ■	■ □	□ ■	□ ■	■ ■
Coaxial cable	□	■	■	■	■	■	■
Protocol Stacks Supported							
NDIS	□	□	■	□	■	■	■
ODI	□	■	□	□	□	■	■
Networks Supported							
ARCnet	□	■	■ (via NDIS)	□	■	■	■
Ethernet	□	■	■	■	■	■	■
LocalTalk	■	□	□	□	□	□	□
Token-Ring	□	■	■	□	■	■	■
Software Requirements							
RAM: client only; server only; client and server	67K, 67K, 67K	23K, 50K, 50K	70K, 62K, 92K	32K, 32K, 64K	125K, 50K, 50K	27K, 53K, 53K	4K, 4K, 4K
Can load in expanded/extended memory	□ □	□ □	■ ■	□ □	□ ■	□ □	□ ■
Program Features							
Interface	DOS, Windows	DOS, Windows	DOS, Windows	DOS	DOS, Windows	DOS, Windows	DOS, Windows
E-mail package	□	□	■	□	■	■	■
MHS-compliant	N/A**	N/A**	□	N/A**	■	□	Optional
Workgroup scheduling package	□	□	□	□	□	■	■
Remote access	□	□	□	□	□	□	■
Network DDE	□	□	□	□	□	■	■
File-Sharing Features							
User can share remote volumes from DOS prompt	■	■	■	■	■	■	■
User can share remote volumes from File Manager	■	■	■	□	■	■	■
User can share multiple hard disks	□	■	■	■	■	■	■
User can execute applications on remote volumes	■	■	■	■	■	■	■
Number of shared volumes supported by each client	1	Unlimited	Unlimited	Unlimited	16	Unlimited	Unlimited
Disk cache included with software	□	□	■	□ ①	■	■	■
Printer-Sharing Features							
Printer attached via parallel/serial port	■ □	■ ■	■ ■	■ □ ①	■ ■	■ ■	■ ■
User can display print queue	■	■	■	□ ①	■	■	■
Manager can display print queue and delete jobs	□	■	■	■	■	■	■
Number of shared printers on the network	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited
Number of shared printers on a single computer	1	5	2	3	3	7	7
Network Management							
Centralized management program available	□	■	■	□	■	■	■
Interface	□	DOS	DOS, Windows	DOS, Windows	DOS	DOS, Windows	Windows
Can analyze packets across the wire	■	■	■	□	□	■	■
Keeps log of all network activities	□	□	■	□	□	■	■
Displays all active users on the network	■	■	■	■	■	■	■
Includes SNMP agent	□	□	□	□	□	□	□
Detects disconnected adapter	□	□	■	□	□	□	□
Security							
Administrator can:							
Configure groups of users for security	□	■	■	□ ①	■ (mail only)	■	□
Hide individual files/directories	□ ■	□ ■	□ □	□ □ ①	□ ■	■ ■	■ ■
Set account expiration date	□	□	□	□	■	■	■ ③
Set log-on time restrictions	□	□	□	□	□	■	■
Password-protect specific resources	□	■	■	□ ①	□	□	■
Assign file-protection rights	■	■	■	□	■	■	■
Toll-free technical support	□	□	□	□	□	□	■
Telephone support hours (eastern time)	11:00-7:00 M-F	8:30-6:30 M-F	8:30-8:00 M-F	9:00-5:30 M-F	8:00-6:00 M-F	10:00-8:00 M-F	9:00-9:00 M-F
BBS	■	■	■	■	■	■	■

N/A*—Not applicable: This package uses proprietary hardware. N/A**—Not applicable: The product does not have this feature. ① Additional printer sharing, disk cache, and security features are available via the PC-MOS add-on. ② The administrator can selectively share directories to achieve a similar result. ③ This feature is available when the product is used with Microsoft Windows NT Advanced Server

[illegible]

SUITABILITY TO TASK

LANTastic

	POOR	FAIR	GOOD	EXCELLENT
File sharing	☒	☒	☒	☐
Printer sharing	☒	☒	☒	☐
Installation and management	☒	☒	☒	☐
E-mail and scheduling	☒	☒	☐	☐
Scalability	☒	☒	☐	☐

As an alternative to DDE, LANtastic includes a network scrapbook that you can use to share data among users on the LAN. You simply cut or copy data from any Windows application to the network scrapbook, and other users can paste that data into their applications. But unlike Windows for Workgroups' Network DDE, this utility cannot automatically link and update data between two users on the LAN.

LANTastic 5.0 retails for \$119 per software license; Artisoft also offers a six-user DOS-only starter kit for \$659 and a \$759 DOS/Windows Ethernet starter kit that includes software, two NodeRunner Ethernet adapters, and cable. Support for NetWare and TCP/IP networks is available as well, so when you want to expand your network, LANTastic 5.0 stands ready to make it easy. (But look for LANTastic 6.0 to overshadow this exceptionally popular product.)

FACT FILE

LANTastic, Version 5.0

*Artisoft Inc., 2202 N. Forbes Blvd., Tucson,
AZ 85745; 800-233-5564; 602-670-7100;
fax, 602-670-7101*

List Price: Ethernet Starter Kit (hardware and software), \$759; each additional node (software only), \$119

Requirements: 640K RAM, 3MB hard disk space (server, peer), 2MB hard disk space (client), DOS 3.1 or later.

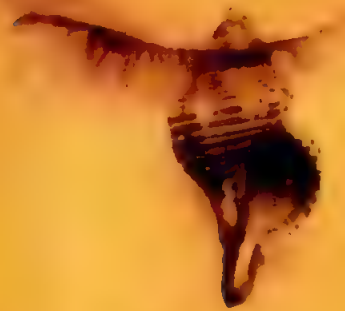
In short: LANtastic 5.0 offers excellent security with easy-to-use DOS and Windows interfaces. It is inexpensive enough for small organizations and powerful enough for larger companies, although it falls slightly short of the mark with only average e-mail and no scheduling. These areas are addressed in Version 6.0, scheduled to be released by the time you read this.



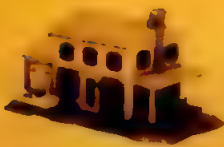
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5



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ing ideas with people right **pages devoted**
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away. The artistry of its new, **Work on your**
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While its unique, color **things you like to**
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design lets it expand for **share with the**
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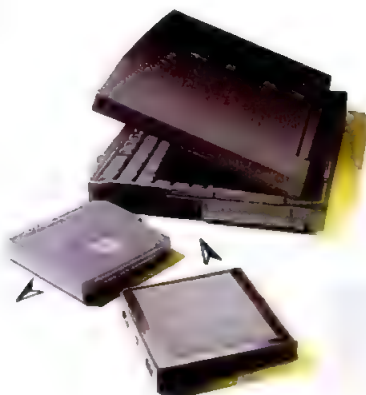
It uses the SL-Enhanced 486DX2 40MHz, 50MHz or new IntelDX4™ 75MHz processor, giving you both efficient power management and uncompromised processor performance. And it combines our latest local bus video technology with a powerful graphics accelerator, for amazingly quick graphics response.

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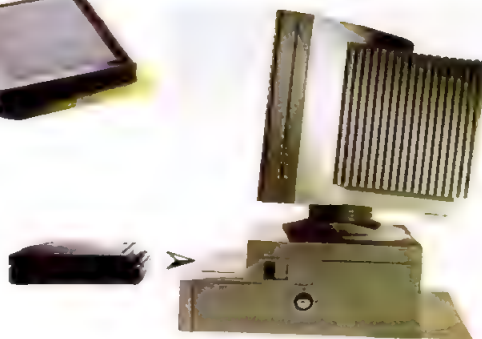
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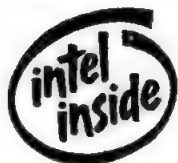


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NEC

Microsoft Corp.

Microsoft Windows for Workgroups, Version 3.11

BY STEVE RIGNEY

Excellent performance, e-mail, network scheduling, and support for fax, DDE, and remote access mark Microsoft Windows for Workgroups (WfWG), Version 3.11, as a leader in the high-end peer-to-peer market. This premium power comes

SUITABILITY TO TASK				
Microsoft Windows for Workgroups				
	POOR	FAIR	GOOD	EXCELLENT
File sharing	●	●	●	○
Printer sharing	●	●	●	○
Installation and management	●	●	●	○
E-mail and scheduling	●	●	●	●
Scalability	●	●	●	●

at a price—\$219.95 for a single user—unless you are upgrading from Windows (\$69.95) or buying a new system with it already installed.

WfWG integrates drive sharing (including CD-ROM) and printer sharing with a Windows interface. And with features such as 32-bit file and disk access,

WfWG is an even better Windows than Windows. Its major shortcoming is lack of built-in support for DOS-only systems.

It's no surprise that WfWG offers the best Windows integration of any package in this roundup. Instead of a separate set of menus and icons for performing network functions, WfWG uses native Windows utilities, such as File Manager and Control Panel, to perform those tasks. Network DDE allows you to link and exchange data with other users on your network. You can, for example, have a Microsoft Word document with an embedded Microsoft Excel spreadsheet. Every time someone makes changes to the spreadsheet, those changes are automatically reflected in your document across the network.

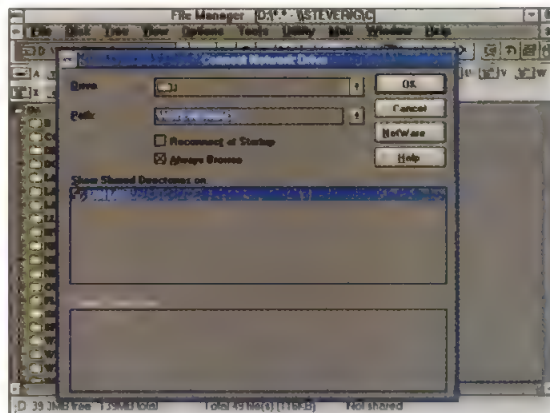
Unfortunately, Windows for Workgroups will not directly support any machine that does not—or cannot—run Windows. A separate product, the \$49.95 Add-on for DOS, will allow non-Windows PCs to share and access files and use e-mail, although its interface is not as friendly as other solutions that work under both DOS and Windows. The add-on also does not include scheduling, and it is slower than its Windows counterpart.

With the exception of the upcoming LANtastic 6.0, WfWG is the only product here that

offers both e-mail and network scheduling: full versions of Microsoft Mail and Microsoft Schedule+. With WfWG, you can also fax messages from your applications using its network e-mail—provided, of course, that you have a fax modem on the network. Although LANtastic 5.0 also supports network faxing, it requires a CAS II fax modem; WfWG will work with nearly any type.

A big plus is Windows for Workgroups' multiprotocol support, which ensures that WfWG will integrate with all major network operating systems. It includes drivers for ODI, NDIS, IPX, and NetBEUI protocols. (You can also purchase TCP/IP support as a substitute for NetBEUI.)

The increased performance of WfWG,



Microsoft Windows for Workgroups allows you to browse and make network connections using File Manager.

■ Artisoft Ups the Ante

By Steve Rigney

With robust e-mail, a scheduler, and multiprotocol support straight out of the box, LANtastic, Version 6.0, aims to go head to head with PowerLan and Microsoft Windows for Workgroups as the ultimate environment for mixed peer-to-peer networks. Artisoft has long been a leader in this market, and its new product continues that tradition. We looked at a beta version of LANtastic 6.0 (scheduled to ship by the time you read this), and found it to be powerful with room for growth. It's a good choice for small and large organizations alike.

The installation program automatically determines which versions of

Windows and DOS are installed in each PC and calls in the correct program elements. You can use the Windows or the DOS interface to create network connections to storage devices and printers. LANtastic 6.0 also comes with all the software you need to interact with a NetWare or Windows NT server, and its universal redirector loads only the protocols it needs for the servers it finds on the LAN.

The program includes powerful security for users and groups, allowing you to assign access to individual files and directories. You can limit network access based on password, time of day, and date. And LANtastic 6.0 includes

a version of network DDE, previously found only in WfWG, that allows you to dynamically share and link information between two Windows applications across the network.

The new Artisoft Mail is a powerful package for Windows and DOS clients. You can send messages to users and groups on the LAN and WAN using many different gateways (including MHS). It supports faxes too. LANtastic 6.0's network scheduler lets you make appointments for everyone on the LAN.

If you're after power, flexibility, and expandability in a peer-to-peer LAN, LANtastic 6.0 looks to have it all. □

FACT FILE

Microsoft Windows for Workgroups, Version 3.11

Microsoft Corp., One Microsoft Way,
Redmond, WA 98052; 800-426-9400;
fax, 206-936-7329

List price: Complete package, \$219.95; Add-on for Microsoft Windows, \$69.95; Add-on for DOS, \$49.95
Requirements: 386-based PC or better, 3MB RAM (server, peer), 2MB RAM (client), 7MB hard disk space, DOS 3.3 or later

In Short: Microsoft Windows for Workgroups is a leader in this market, with excellent performance, e-mail, and scheduling, and support for CD-ROMs, fax, and remote access. Of course, it has the best Windows integration in the field—it's a better Windows than Windows, with integrated networking thrown in. It is puzzling that WfWG has no built-in support for DOS systems, and you do pay for all that power and performance.



Version 3.11, is based on a new 32-bit file access technology and the amount of RAM in your system. We recommend at

least 4MB to 8MB of RAM for your client PCs and 8MB to 16MB for a server.

If you're running a Windows-only network, Windows for Workgroups has an excellent mix of features and ease of use. Even if you don't use the built-in peer-to-peer networking, Windows for Workgroups offers better performance for your Windows desktop. But if you have any DOS-only systems, you'll need to buy the extra module. Otherwise, WfWG is a well-integrated package with a great Windows interface.

Moses Computing

MosesALL!, Version 1.97

BY JOHN GARRIS

For a low-cost bundled solution that includes everything you need to network a small number of computers, check out MosesALL!, Version 1.97. For \$178 total for hardware and software for two users (\$89 for each additional user), it delivers basic file sharing and print services and an easy installation. Note though, that

SUITABILITY TO TASK

MosesALL!

	POOR	FAIR	GOOD	EXCELLENT
File sharing	●	●	○	○
Printer sharing	●	●	○	○
Installation and management	●	●	●	○
E-mail and scheduling	●	○	○	○
Scalability	●	○	○	○

it's a slow performer, and it has a few quirks.

Installation was not one of them. With the proprietary cards, the most you'll need to do is adjust a jumper setting or two (a well-documented procedure). We quickly hooked our computers together with the included cabling. Then we installed the software on each system, which made all necessary changes to the CONFIG.SYS and AUTOEXEC.BAT files.

MosesALL! does not have a Windows interface. The DOS program is adequate but could be more user-friendly. And the

Introducing LANtastic 6.0.
For the most complete
office network solution.

Everyone in the office can run the computers. The printers. The fax (okay, so Bob's still trying). But despite all the wires, your office still doesn't connect. Before you throw up your hands, throw around this idea: new LANtastic 6.0

The LANtastic 6.0 network operating system combines state-of-the-art computer networking with built-in e-mail, a scheduler and fax capabilities. So communicating around the office (or around the world) can be done right at your desk. No third-party software. No time-wasting steps

What's more, a LANtastic system can operate peer-to-peer, as a dedicated server, or anywhere in between. (Talk about network



LANtastic® is the first network connect

NETWORKING

Peer-to-Peer Networks

FACT FILE

MosesALL!, Version 1.97

Moses Computers, 15466 Los Gatos Blvd.,
#201, Los Gatos, CA 95032, 408-358-1550;
fax: 408-356-9049

List Price: Starter Kit for two users, \$178, each additional user, \$89. MosesUPI adapter card, \$139.

Requirements: 18K RAM (server), 31K RAM (peer), 13K RAM (client), 300K hard disk space, DOS 3.3 or later.

In short: Economically priced, MosesALL! is a bundled hardware/software solution that delivers basic file and print services with an easy installation. Like most of the other lower-end packages, it is slow and has some quirks. Remember, too, that proprietary hardware limits you to one vendor.

ON READER SERVICE CARD

Security could be better as well. Although you can require others to use a password to access a directory on your local system, the user on that computer must specify the password each time his system boots. If he mistypes it, other users will find that the password does not work. The alternative is to put the password in the MOSES.BAT file, an unencrypted text file with no security.

MosesALL! has other rough spots too. We noted that if users did not log out of the network before shutting down, for example, one server's session pool became full and additional users were denied access. We had to reboot the server, thus disconnecting all the current users. That restarted the session pool and allowed all the users to connect.

MosesALL! is a relatively simple, all-in-one package that provides reliable basic file and print services. Other prod-



A simple DOS-based interface lets you set up and configure a MosesALL! network using a series of menus.

ucts in the same range, though, offer more features and are easier to use.

Novell Inc.

Personal NetWare

BY JOHN GARRIS

Personal NetWare, Novell's long-awaited replacement for NetWare Lite, offers bet-

ing people. Not just computers.



flexibility.) All at quicker speeds than LANTastic 5.0 for even faster printing and file sharing.

Now that's what I call productive, you say. But you already have an enterprise LAN? No problem. LANTastic 6.0 is the ideal workgroup solution. With our universal client, you can access the broadest range of networks around—including servers from Novell, Microsoft, IBM and others.

But how about installation? Well that's easy, too. The LANTastic 6.0 system is intuitive and reliable. So it's a breeze to learn and maintain. (Even for Bob.) And the price makes the thought of everyone working together even nicer.

So learn how LANTastic 6.0 can really connect your office. Call an Artisoft Authorized Five Star™ Reseller or Artisoft directly at 1-800-809-2087.

LANTastic by

ARTISOFT®
A better way to network people.

Personal NetWare

List Price: One user, \$99; five users, \$395. Upgrade from Novell Lite, \$39.95 per user. Upgrade from DR-DOS 6 to Novell DOS 7, \$39.95 per user (Novell DOS 7 includes Personal NetWare).

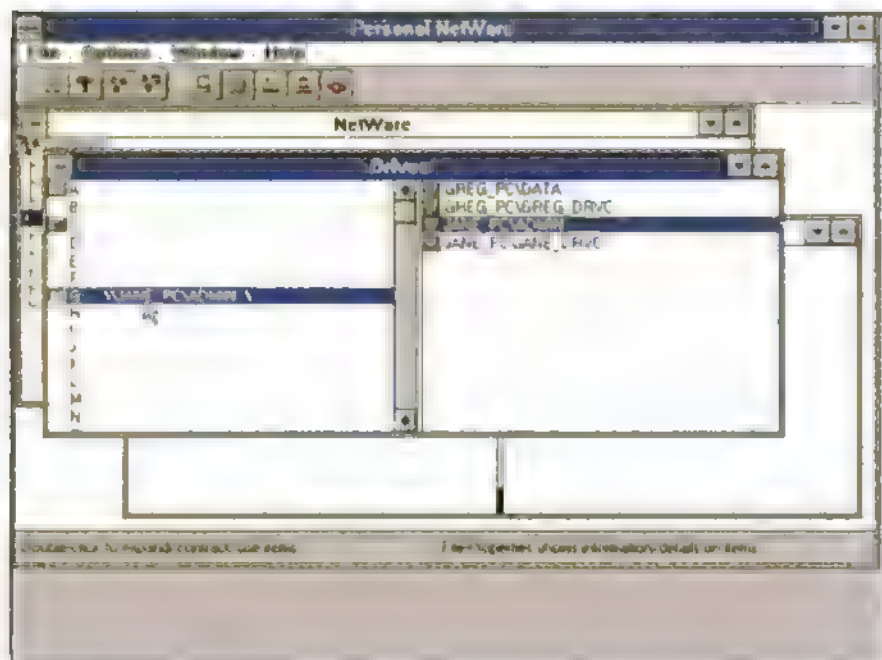
Requirements: 45K RAM, (server), 137K RAM, (peer), 92K RAM, (client), 4.3MB hard disk space (server), 7.4MB hard disk space (peer, client), DOS 3.3 or later.

In short: If you want to add peer-to-peer capabilities to a NetWare network, Personal NetWare makes it easy. It provides strong, centralized management, but its performance is sluggish, its Windows interface is weak, and, unlike some of the other higher-end packages here, it has no built-in e-mail or scheduling.



ter integration with server-based NetWare and very strong management capabilities. Its performance, however, remains sluggish, and it lacks network applications, such as e-mail and workgroup scheduling, found in other high-end peer-to-peer products. If you have a NetWare 2.x, 3.x, or 4.x network, it's a good choice for any new workgroups you choose to set up.

Installing Personal NetWare is simple, and the software detects whether you have full NetWare in place. Because it supports ODI, the software works with almost any Ethernet card; you choose yours from a long list. You have to name each machine, choose which resources to share, and reboot. A single set of virtual loadable modules (VLMs) then lets you



It's easy to assign drive letters to remote directories using Personal NetWare's drag-and-drop Windows interface.

SUITABILITY TO TASK

Personal NetWare

	POOR	FAIR	GOOD	EXCELLENT
File sharing	☒	☒	☐	☐
Printer sharing	☒	☒	☒	☐
Installation and management	☒	☒	☐	☐
E-mail and scheduling	☒	☐	☐	☐
Scalability	☒	☒	☒	☐

connect client PCs to any Personal NetWare or regular NetWare server. If you already have a NetWare network, you can add Personal NetWare without affecting those network connections. The VLM software eliminates the need to configure gateways to NetWare networks or to load separate client software to access NetWare servers.

You can manage through either DOS or Windows, but the Windows interface is confusing and awkward. One window displays all the network resources, such as users and shared directories, but there is very little hierarchical order to the display. Furthermore, the process of adding user accounts or connecting to shared directories was not very intuitive. The DOS interface, on the other hand, is adequate. After you understand a few quirks with the menu structure, performing administrative tasks becomes straightforward. There is also a DOS command line, with provided on-line help.

Personal NetWare's strength is in its powerful, centralized management capabilities. Workgroup administrators can bolster security by requiring users to change passwords regularly and can restrict user log-on to specific times of the day. (Another of the good features that Personal NetWare carries from its server-based cousins is that users need to log on only once to access all servers.) There is also an audit log that records when users log on or off, and all management tasks can be performed from any workstation on the network. The workgroup administrator can view print queues, prioritize print jobs, and view printer errors.

cludes a diagnostic program that allows the workgroup administrator to compare server and client network traffic, server utilization, available shareable disk space, and physical information (such as memory and network cards) for both clients and servers. An SNMP agent is available to allow Novell Network Management Stations (NMSs) to gather information about Personal NetWare clients.

Personal NetWare, like its predecessor NetWare Lite, suffers from poor performance, scoring worse than most of its competitors on our performance tests. If speed is a primary consideration, you may want to look at other packages such as Windows for Workgroups or PowerLan.

Personal NetWare is a logical choice for users who have a larger number of computers or for those who are planning an upgrade to regular NetWare in the near future. If you are simply connecting a small group of computers together, however, Personal NetWare's powerful management features do not offset the performance and ease-of-use problems you're likely to encounter.

Performance Technology Inc.

PowerLan, Version 3.0

BY STEVE RIGNEY

Ideal for medium-size to large organizations looking for a powerful networking solution, PowerLan, Version 3.0, is a peer-to-peer LAN that offers room for growth. But it is also easy to install and use, and it's priced well enough for smaller sites. It can network DOS and Windows clients, has excellent integration with Windows NT, and it includes PowerServe, a separate 32-bit server program that makes it an excellent client/server product.

SUITABILITY TO TASK

PowerLan

	POOR	FAIR	GOOD	EXCELLENT
File sharing	☒	☒	☒	☒
Printer sharing	☒	☒	☒	☒
Installation and management	☒	☒	☒	☒
E-mail and scheduling	☒	☒	☐	☐
Scalability	☒	☒	☒	☐

Samsung

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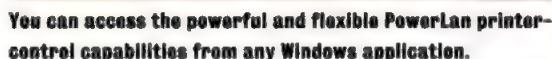
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SyncMaster	14GL	15GL	17GL
Size	14"	15"	17"
Dot Pitch	.28	.28	.28
Maximum Resolution	1024 x 768	1024 x 768	1280 x 1024
Maximum Refresh Rate at Maximum Res. (Hz)	76	76	60
MPR-II (Low radiation)	•	•	•
Power Management	•	•	•
Flat Square Screen		•	•
On-Screen Programming			•
Warranty	2 Years	2 Years	2 Years

CIRCLE 046 ON READER SERVICE CARD



The PowerLan Windows interface is intuitive and fun to use. When you need to connect to a network resource, such as a shared disk drive, you drag a power cord—representing the local drive letter—and plug it into a wall outlet representing the remote drive. The same applies to networked printers and other

SUITABILITY TO TASK				
SilverNET-OS				
	POOR	FAIR	GOOD	EXCELLENT
File sharing	●	●	●	○
Printer sharing	●	●	○	○
Installation and management	●	●	●	○
E-mail and scheduling	●	●	○	○
Scalability	●	●	●	○

networking beginners, is excellent, and both the DOS and Windows interfaces make configuration simple and straightforward.

There are some problems. Unlike most of the other packages in this roundup, SilverNET doesn't provide a directory browser when you are setting up resources to be shared; you must type each path manually. Connecting to a shared device is easier, because available servers appear in a list, along with their shareable drives and printers. We liked that SilverNET automatically re-establishes connections when a server that has gone down comes back on-line.

Basic electronic mail, instant messaging, and live chat functions are provided. All are easy to use, but the e-mail is adequate only for the least demanding applications; "carbon copies," forwarding, mailing lists, and file attachments are missing, and the message editor is crude. Users cannot view their mail on a client station other than their own, because SilverNET makes no distinction between users and their computers.

SilverNET's print spooler worked smoothly in our tests, but only users with

supervisory rights can view or change the print queue, prioritize and delete print jobs, and view their status. Users can delete their own print jobs.

SilverNET is not designed for centralized management. User groups are not available, so there is no easy way to assign network privileges by category. And you cannot view users and resource utilization for the network as a whole, only server by server. Likewise, SilverNET's password-based security scheme is not suited for larger or complex installations. Each shared resource and mailbox can be protected individually, but it is not possible to assign different passwords to different users.

In our performance tests, SilverNET-OS consistently placed in the faster half of the group, while demanding little CPU bandwidth. And, surprisingly, in some tasks it outperformed even market heavyweights such as LANtastic and PowerLan. The nondedicated server configuration performed almost as well as the dedicated server, a plus for sites with limited resources.

Artisoft Inc.

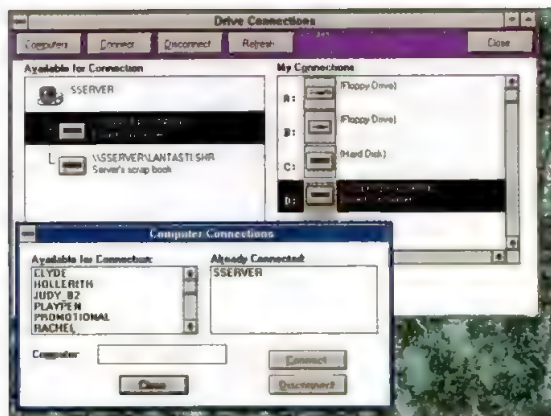
Simply LANtastic, Version 5.1

BY STEVE RIGNEY

Simply LANtastic, Version 5.1, offers good performance compared to other lower-end peer-to-peer networks, includes easy-to-use menus under both

DOS and Windows, and has one of the easiest installations in this field. It's an entry-level network operating system, with a clear expansion path, designed for homes and small businesses. A scaled-down version of LANtastic, it costs just \$299 for a two-node starter kit. In addition to allowing the sharing of hard disks, CD-ROM drives, and printers, it includes a basic e-mail package and limited network security.

This simpler Artisoft prod-

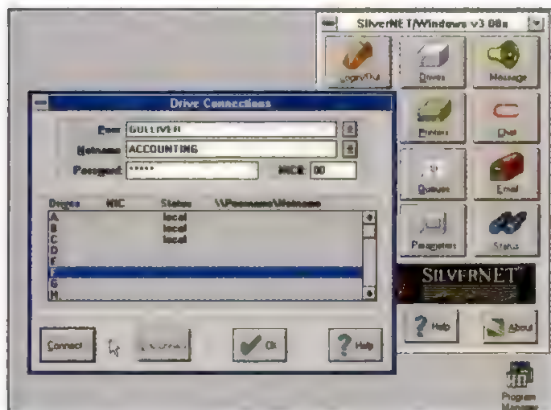


Simply LANtastic offers an easy-to-use Windows interface for making network connections.

uct automatically determines if you have Windows installed and then sets up your icons and network drivers. The interface offers clear syntax, such as "My A: drive" to represent your local resources and those available on the network. Simply LANtastic's features are similar to those of Desk to Desk—except that it has a more intuitive interface and includes e-mail. And although the Simply LANtastic adapter cards are proprietary, they are compatible with both standard Artisoft NodeRunner cards and Ethernet cable and offer much better performance.

These internal adapter cards are not as easy to install as the parallel-port adapters used with Coactive Connector, but they are simple to configure and provide excellent throughput: 10-Mbps signaling compared with Coactive Connector's 256 Kbps. In general, its test scores are similar to those of its principal competitor Desk to Desk.

Simply LANtastic's communications features are limited but adequate. It does not provide an on-line chat feature, but it does offer an e-mail system that lets you



A simple and straightforward Windows interface is one of SilverNET's strong points.

SUITABILITY TO TASK				
Simply LANtastic				
	POOR	FAIR	GOOD	EXCELLENT
File sharing	●	●	●	○
Printer sharing	●	●	○	○
Installation and management	●	●	●	○
E-mail and scheduling	●	●	○	○
Scalability	●	●	○	○

send text and binary files to other users on the network.

It does not, however, offer support for network groups, and security is limited to password protection and full, read-only, or no access privileges to resources. The print control program allows you to view the network queue and either rush or delete individual jobs. It does not allow you to place banners, headers, and trailers on print jobs.

Simply LANtastic is, not surprisingly, totally integrated and compatible with the full version of LANtastic, and it offers plenty of room for growth. Moreover, because Simply LANtastic uses the NetBIOS protocol, you can even access volumes and drives on a NetWare network simply by going through a LANtastic server.

Although Simply LANtastic is designed primarily for small businesses and offices, the ability to move easily to LANtastic—and from there up to NetWare—offers you guaranteed flexibility in any future expansion plans. And with easy-to-use Windows and DOS interfaces, even a novice user can quickly make network connections to disk drives and printers.

Tiara Computer Systems Inc.

10NET 5.1 LAN Operating System

BY STEVE RIGNEY

Offering the security, printing capabilities, and performance of a high-end peer-to-peer network, 10NET 5.1 LAN Operating System still lacks the intuitive Windows

interface of comparable packages. It was simple to use, but this Tiara Computer Systems product has weak communications, which hinder it from sitting securely on the top rung.

Both the DOS and Windows installation programs were easy to use.

There are some frustrations, however, including the way 10NET sets up a server's local hard disk: The disk is not accessible to other users until you make a poorly documented change in the GONET.BAT file. Once you get over these initial hurdles, you can easily share and connect to network resources. In addition, 10NET includes support for NDIS, NetBEUI, and SMB protocols, so you can connect pretty easily to most major network operating systems.

Network printing is one of 10NET's strong points. One feature, called *hyperprinting*, enables it to start printing your document even before the entire job has been sent. 10NET also compresses your PCL files to increase throughput further and allows you to set up print queues on

SUITABILITY TO TASK

10NET LAN Operating System

	POOR	FAIR	GOOD	EXCELLENT
File sharing	●	●	○	○
Printer sharing	●	●	●	○
Installation and management	●	●	○	○
E-mail and scheduling	●	●	○	○
Scalability	●	●	●	○

FACT FILE

10NET 5.1 LAN Operating System

Tiara Computer Systems Inc., 1091 Shoreline Blvd., Mountain View, CA 94043; 415-965-1700; fax, 415-965-4807

List price: Software only; 2-node starter pack, \$198; 1-node expansion pack, \$89; 5-node starter pack, \$445; 10-node starter pack, \$789; 20-node starter pack, \$1,380; 100-node site license, \$1,999.

Requirements: 286-based PC or better (server (386-based PC for file server), client), 386-based PC or better (peer), 120K RAM (server, peer), 70K RAM (client), 1MB hard disk space, DOS 3.0 or later.

In Short: 10NET delivers the performance, security, and network printing of a good higher-end peer-to-peer product, but it is hindered somewhat by its lack of an intuitive Windows interface and any kind of e-mail or network scheduling. 10NET is a higher-end product, and with its complexities, it is not designed for novice users, who need a more intuitive interface.

ON READER SERVICE CARD

PCs without a network printer attached.

Although 10NET provides a basic chat function, it does not offer any e-mail or network scheduling (Tiara suggests that many businesses like to buy these packages separately). That, coupled with the lack of support for CD-ROM drives that use MSCDEX (Microsoft CD-ROM Extensions), lessens 10NET's appeal at the higher end. (Tiara is working on a release that will support MSCDEX.)

This product provides strong security including passwords, user names, groups, and an audit utility. You can give users access to the network based on user name, time of day, or month, and you can use the audit utility to monitor individual usage and connection attempts.

10NET is a good solution that delivers strong security and network printing, and decent performance. And with a retail price of \$89 per software node or \$198 for a two-user starter kit, 10NET is competitive with both higher- and lower-end products. But much improvement is needed in the Windows and DOS interfaces to make the package more intuitive. □

FACT FILE

Simply LANtastic, Version 5.1

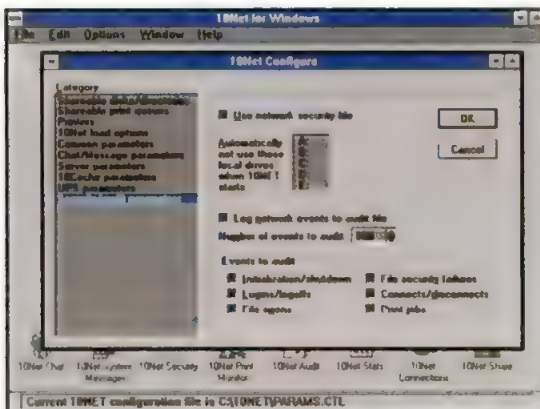
Artisoft Inc., 2202 N. Forbes Blvd., Tucson, AZ 85745; 800-233-5564, 602-670-7100; fax, 602-670-7101

List Price: Simply LANtastic Starter Kit \$299; each additional node, \$79.

Requirements: 640K RAM, 3MB hard disk space, DOS 3.1 or later.

In Short: With an easy-to-use interface and features such as e-mail and DOS and Windows menus, Simply LANtastic is designed for small-business and home-office use. Because of its integration with LANtastic, Artisoft's higher-end product, it is a good choice for both small organizations and those that want to start small but need room for growth.

ON READER SERVICE CARD



10NET offers powerful security features including an audit file and network access based on time and day of the week.

Network Edition

THE LATEST NETWORK PRODUCTS AND MANAGEMENT TECHNIQUES

Room to Grow

The recipe for stretching a peer-to-peer LAN calls for performance, reliability, scalability, and remote access. Does your peer-to-peer LAN offer the right ingredients?

by Frank J. Derfler, Jr.

What do puppies, plants, children, and peer-to-peer LANs have in common? They all grow. But while puppies, plants, and children can grow to ten times their size and still stay essentially the same, LANs that double in size typically need to be rebuilt from scratch. Peer-to-peer LANs typically lack *scalability* (the ability to expand smoothly), though some offer an effective expansion tool: 32-bit server software.

So how do you expand a LAN? Making sure to preserve your LAN's performance and reliability, mix in the ability to communicate with and beyond other LANs along with the extra nodes. *PC Magazine* and ZD Labs examined four

peer-to-peer LANs for scalability, inter-LAN networking, and reliability characteristics in several ways: First, we uncovered the maximum number of active nodes that these dedicated servers could realistically support without a noticeable degradation from the user's perspective. Then we looked at one of the

key underpinnings of scalability: the ability to use the widely supported and routable TCP/IP network protocols. Finally, we examined some aspects of server reliability.

All of the products that we reviewed here offer server software that goes beyond 16-bit, single-tasking DOS to offer a 32-bit operating system. This makes sense, since DOS-based servers falter under heavy loads. Invisible Software offers server software called UltraServe for its InvisibleLAN. Performance Technology's POWERserve server comes bundled with the company's PowerLAN. NetWare 3.12 is the clear but costly growth path for Personal NetWare.

Finally, Microsoft Windows NT is the logical choice for Windows for Workgroups. We weren't able to test NT with Windows for Workgroups clients, so we did the next best thing: We looked at the software with LAN Manager clients. Though our performance numbers reflect Windows NT's performance with Microsoft LAN Manager's clients, you

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Thanks to Boundary Routing

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Carter's never misses a due date.



of our remote sites from our central office," says Anthony Barber, manager of technical services for Carter's.

"What's more, our corporate executives now have direct access to vital sales information through their own PCs."

With 3Com's Boundary Routing, Carter's gets all the benefits of remote routing without the complexity.

Clothing manufacturers aren't the only ones who have discovered that 3Com's Boundary Routing technology is the simplest and most cost-effective way to add branch offices to the corporate network. For a free video, *Plug and Play Remote Networking*, along with complete product information, call **1-800-NET-3Com**. And see how you can take advantage of your growing market.



Networks That Go the Distance™

should expect roughly the same performance with Windows for Workgroups clients. We compared these results against a NetWare 3.11 baseline.



EDITORS' CHOICE

• PowerLan

One noticeable absence from the group of vendors we compiled is Artisoft, whose LANtastic network operating system is the leader in the peer-to-peer market. The company showed us a beta version of LANtastic, Version 6.0, with strong expansion capabilities that is expected to enter distribution about the time that this story is published. (See "Peer Pressure" in this issue for further testing of peer-to-peer networks.)

ADDING NODES

The best way to handle a growing load on a server is to dedicate the server to networking and eliminate DOS, which is the way we ran our tests. POWERserve and UltraServe performed beautifully even when compared with the ever-popular NetWare 3.11. Neither matches NetWare or Windows NT in all features, but both can move a lot of data across the network quickly.

POWERserve is the better buy of the two in this regard. This 32-bit server performed well and includes a sophisticated naming scheme that replicates a database of names and privileges across log-on servers, giving PowerLan, our Editors' Choice, the best ability to manage a multiserver network among all the products that we tested. PowerLan also worked nicely with both Windows for Workgroups and Windows NT: Just add Windows NT to the network and all the PowerLan nodes will immediately be able to use its resources.

UltraServe provided the fastest service under light loads among the tested products. It has drawbacks, though: This \$399 product doesn't offer the third-party support of NetWare and Windows NT, nor does it include the extended scheme of POWERserve. Additionally,

Only PowerLan allows DOS and Microsoft Windows clients to grow cost-effectively into an internetworking system without major reconfiguration. Key to this migration path is PowerLan's conformance to Microsoft standards and products. This enables it to

work with other operating systems and with third-party utilities.

Windows for Workgroups has great scalability, but only for Windows clients. Also, Windows NT is more expensive than POWERserve, which comes bundled with PowerLan. It's a shame that the new client software from Version 1.1 of the NetWare Client Kit, which would have made IP

services available on every node, didn't make it into Personal NetWare. (Adding IP tunneling to Personal NetWare is useful, but complex.) UltraServe had great performance, but the internetworking and management tools simply aren't there.

On the bottom line, PowerLan provides open, linear, and low-cost room for growth.

UltraServe costs about \$300 more than POWERserve.

NetWare 3.12 is an obvious expansion path for Personal NetWare, though it does carry a high up-front cost (about \$5,000 retail for a 50-user version, plus the cost of the PC hardware). Still, it provides good performance and many features,

choice would be a NetWare server, since the structure of Windows for Workgroups makes it very easy to add NetWare software to Windows for Workgroups clients.

Expanding Your LAN

How do you expand a LAN? You add performance, reach, and reliability. Server software with 32-bit multitasking capability enhances performance, routable networking protocols add internetworking capability, and other utilities add reliability.

32-bit multitasking	Internetworking TCP/IP	Mirroring/UPS management
PowerLan can use POWERserve or Windows NT. Personal NetWare uses NetWare 3.12. Portable LAN uses UltraServe; Windows for Workgroups uses Windows NT.	Windows for Workgroups and PowerLan can use TCP/IP for all client/server functions. Other products provide TCP/IP service only for specialized programs.	POWERserve includes mirroring and a UPS interface. Other products rely on third-party add-ons for these features.

including the ability to run any of the hundreds of third-party NetWare Loadable Modules.

Finally, when the number of clients on your Windows for Workgroups server surpasses one or two dozen, you'll want to use a network operating system with real multitasking capabilities, and the most logical choice is Windows NT, which costs for \$495 per server. Another

REACHING OUT

The number of clients a server can support is just part of the story. Perhaps more important are the facilities that run on the NOS.

One obvious example is remote access. No business does business in just one place anymore. Today, network scalability means giving people dial-up remote LAN access and linking LANs. Microsoft includes a remote-access server in Windows NT, and Artisoft markets remote-access hardware and software for LANtastic 5.0. Many companies, including Digital Communications Associates, IBM, Microcom, Shiva, and Stampede, sell remote-access products for all of the NOSs, but LAN-to-LAN links are a trickier challenge.

Because telephone circuits that link LANs are expensive, you want to strip off the outer network frame and only send the smaller data packet across the inter-LAN link—a technique called *routing*. All of the products in this review except

The only network management solution for people who won't take no for an answer.

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DOS & Windows Menuing	Yes	No	No
Application Metering	Yes	Yes	Yes
File & Software Distribution	Yes	Yes	No
Hardware Inventory	Yes	Yes	Yes
Software Inventory	Yes	Yes	Yes
.INI File Management	Yes	No	No
Printer Management	Yes	No	Yes
Disk Monitoring	Yes	No	Yes
Alarm Notification	Yes	No	Yes
Scripting Language	Yes	Yes	No

Look closely at the leading network management solutions and one thing's perfectly clear.

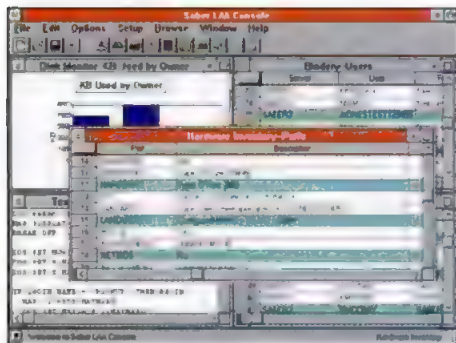
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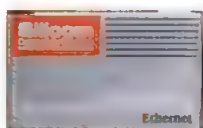
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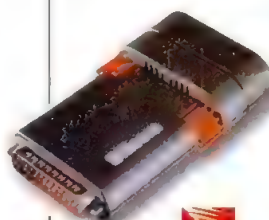
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CIRCLE 949 ON READER SERVICE CARD

Personal NetWare use Microsoft's NetBEUI to carry data across the network. Unfortunately, the fast and efficient NetBEUI doesn't include enough information about the destination station for effective routing.

The popular alternative to NetBEUI is the Internet Protocol (IP), which is part of the TCP/IP protocol suite. All of the products in this review support TCP/IP, but the word *support* has at least two meanings. PowerLan and Windows for Workgroups both replace NetBEUI with TCP/IP so that they are ready for internetwork links. But InvisibleLAN and LANtastic 5.0 only provide TCP/IP services that operate in addition to NetBEUI, so messages from the clients and servers don't cross the internetwork. Personal NetWare provides several options, including a way to encapsulate IPX packets within IP to cross a backbone LAN.

How do you shoehorn TCP/IP in place of or next to NetBEUI? Each of these network operating systems uses at least one of the three industry-standard LAN adapter interfaces: Microsoft's NDIS, Novell's ODI, or the public-domain Packet Driver. PowerLan and Windows for Workgroups can use all three, Artisoft has focused on NDIS, Invisible uses the Packet Driver and an older form of NDIS, and Personal NetWare uses Novell's ODI. These network adapter interfaces make it possible to load TCP/IP software between the network operating system and the LAN adapter. Most TCP/IP vendors offer a NetBIOS interface at the top of the TCP/IP protocol stack. Because this interface reacts like NetBEUI, the networking software in Windows for Workgroups and PowerLan is fooled while IP carries the network traffic load.

For users of Windows for Workgroups 3.11, Microsoft provides both IPX "support" and real TCP/IP service. Microsoft has a clever way for specific utilities, such as management or

terminal emulation programs, to use Novell's routable IPX protocol within Windows for Workgroups. The Microsoft IPX driver loads next to the stan-

were done. (The Windows for Workgroups TCP/IP driver is available on CompuServe (GO MSCLIENT), on the Internet (<ftp.microsoft.com:/Advsys/MSclient/WFW>), and also on Microsoft's bulletin board (206-936-MSDL)).

PowerLAN was another success story. The product is supposed to work with any commercial TCP/IP stack for DOS or Windows. We chose the popular PC/TCP from FTP Software with the ODI adapter interface. ODI needs a file called LSL.COM with linking information for each network adapter, but you can get that from the adapter vendor. The PC/TCP's installation program identified ODI in memory and configured PC/TCP. Everything worked the first time.

Installing PC/TCP with InvisibleLAN didn't go quite so well. After receiving brief instructions from Invisible and installing both programs several times by themselves, we still found it nearly impossible to make them work together. We found poor integration between the networking software and the adapter drivers

showed in interrupt and addressing problems, load-order problems, and inconsistent IP performance.

Personal NetWare uses Novell's IPX as its network communications protocol, so it is ready for internetworking. If you want to use IP, you have three options: On the simplest level, the \$99 NetWare Client Kit, Version 1.1, gives you basic TCP/IP services for all your LAN nodes. For more utilities, such as the Internet's TELNET, PING, FTP, and others, Novell markets LAN Work-

Place for DOS, Version 4.01, for \$450 per node. If you want the traffic between Personal NetWare clients and servers to cross an IP link, you have to install a product called NetWare/IP (\$1,800 for 50 nodes) in a dedicated computer.

Installing LAN WorkPlace on a Personal NetWare client did not seem to be all that difficult a task until the

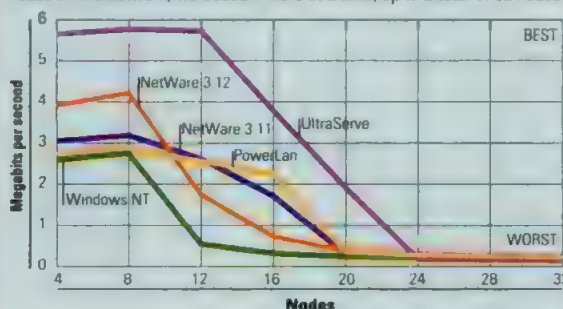
Network Scalability



Peer-to-peer LANs are not supposed to scale well, but don't tell that to the people at Performance Technology. Their product, PowerLan, performed solidly, matching the much more expensive NetWare

3.11 but not surpassing the newer NetWare 3.12. Invisible's UltraServe outperformed PowerLan and both versions of NetWare on the lighter loads but trailed off dramatically when we increased network traffic. Windows NT might have done a bit better with Windows for Workgroups using Microsoft's 32-bit drivers but, we suspect, not enough to allow it to surpass these other packages.

At ZD Labs, we tested the scalability of these products with the I/O Throughput test from NetBench 2.06 using a 1MB test file and transmitting 512-byte data packets across the network. As a server we used a Dell 450/ME with 16MB of RAM and an Eagle NE3200 adapter. Starting with 4 nodes on the network, we added 4 more at a time, up to a total of 32 nodes.



dard Microsoft protocols (either NetBEUI or IP) and allows these programs to make calls to IPX. The file and print services don't use IPX, but programs that need IPX can use it.

*All of the products in
this review support TCP/IP,
but the word support has at
least two meanings.*

In the labs, the TCP/IP for Windows for Workgroups installation went very smoothly. We downloaded the archived file, expanded it, and put the contents onto a floppy disk. We opened the Network Setup application and added the new network protocol from the floppy. A dialog box asked us for our IP address, automatically picked the correct netmask, and we

TCPIP.EXE failed to load. An investigation showed that LAN WorkPlace installed a complete ODI stack in the wrong directory; this is an easy mistake to miss if you are not a well-versed NetWare administrator.

In Version 5.0 of LANtastic, Artisoft offers both a trick and a treat. The trick is a way to move the Artisoft NetBIOS packets through an IPX router and the treat is a product with excellent capabilities called LANtastic for TCP/IP. Using special installation options, the IPX_ROUTING switch on AILANBIO and the IEEE switch on the low-level driver, LANtastic adds an IPX header to NetBIOS. This allows LANtastic packets to go from one LANtastic network, through most IPX routers, to another LANtastic network.

LANtastic for TCP/IP does not replace the protocol stack; it provides TCP/IP services for application. The LANtastic packets don't use IP, but you

can use Internet utilities and terminal emulation over IP. Version 6.0 of LANtastic, which we saw in beta stage, focuses on NetWare compatibility using IPX to improve both its power and its reach.

*Performance Technology's
POWERserve has excellent monitoring
and management capabilities along
with a good UPS interface.*

LAN reliability is even more important than LAN performance. Total system reliability comes from a variety of features, including some means of monitoring server performance, a way to mirror disk drives, and other capabilities such as the ability to use the status messages sent from an uninterruptible power supply, for example.

Here is where POWERserve really shines, providing about the same func-

tions as NetWare 3.12 or Windows NT. Performance Technology includes excellent monitoring and management capabilities along with a good UPS interface. POWERmirror, a flexible disk mirroring program, is a competitively priced \$249 add-on.

Third-party products can enhance reliability. Windows for Workgroups can use a variety of mirroring, backup, troubleshooting, and UPS interface programs made for Windows. Other NOSs have fewer options, but some can work with third-party products (except Personal NetWare) such as Immunity from Unitrol Data Systems, a useful \$249 product that mirrors disks between dissimilar uncompressed drives.

Scalability isn't hard to understand. It comes from flexibility and processing power. However, it requires a modular design and development work that pays attention both to standards and interoperability. □

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NETWORK FEATURES

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- ♦ Can notify user of job completion and printer errors
- ♦ Supports encrypted passwords
- ♦ Shows status via Netware's PSC and PCONSOLE
- ♦ Installation program simplifies setup
- ♦ Auto detects and uses 802.3 and Ethernet II
- ♦ Auto detects and attaches to new file servers
- ♦ Simultaneous queue server and PSERVER modes

TCP/IP FEATURES

- ♦ Finds IP address from BOOTP, RARP, or memory
- ♦ Supports LPR, RSh, Rexec, and standard TCP/IP connections to any TCP/IP host
- ♦ Configure using Telnet, TFTP, or the serial port
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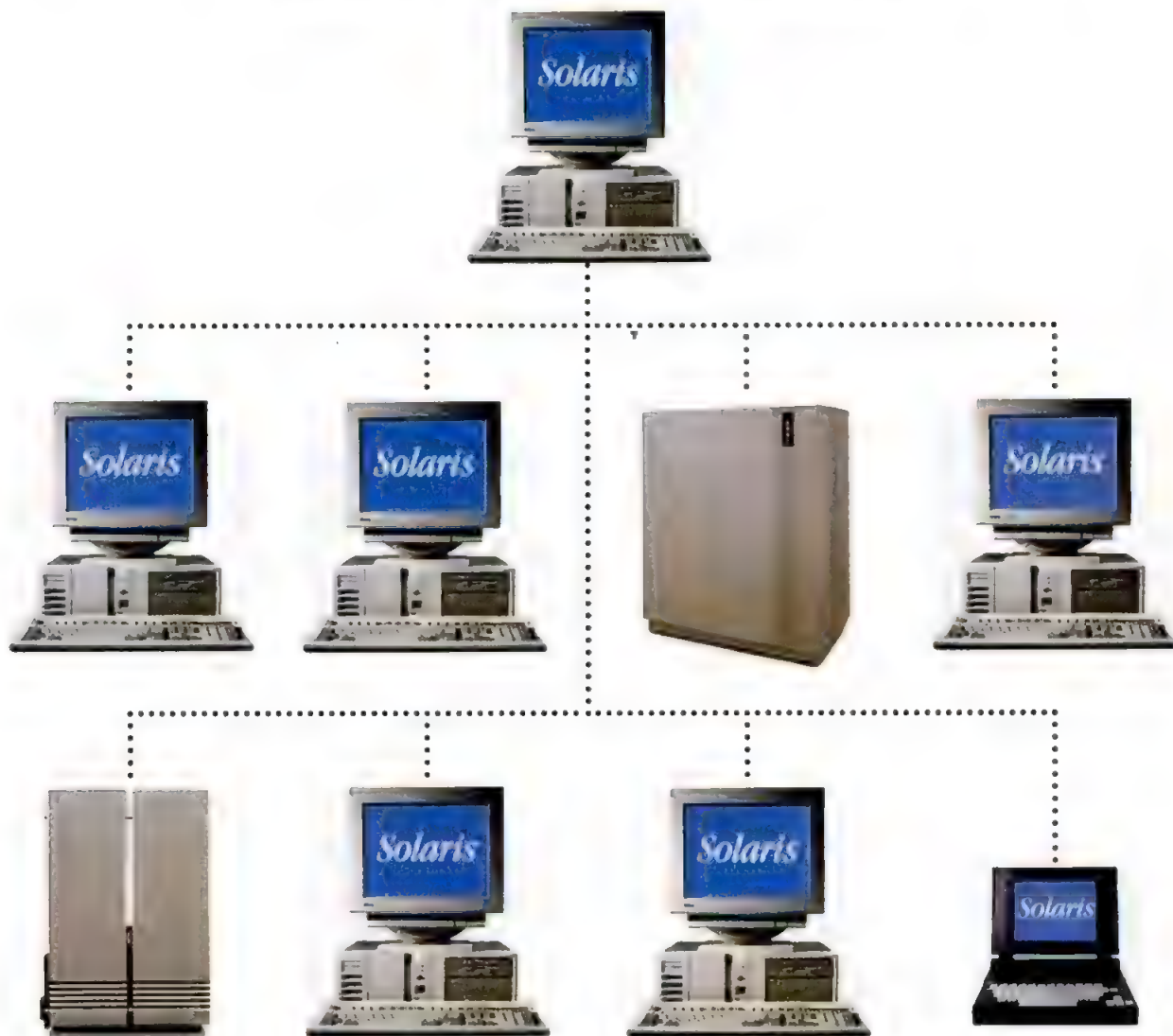
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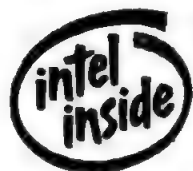
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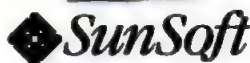
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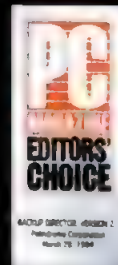
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FIRST LOOKS

HANDS-ON EVALUATIONS OF THE NEWEST NETWORK PRODUCTS

► REMOTE-ACCESS SERVER

3Com Supports Two Types of Access

BY JEFFREY D. BAHER

In order to stand out in the remote-access market, a product has to be fairly unique. 3Com's AccessBuilder remote-access server is just that: In addition to supporting simultaneous remote-node and remote-control client sessions, the AccessBuilder supports dial-up routing over both synchronous and asynchronous lines with up to 16 modem lines for a single connection.

The AccessBuilder arose from 3Com's January purchase of Centrum Communication Associates: Until recently, the AccessBuilder was sold as the CentrumRemote 3000/E. Because it supports dial-up routing, the AccessBuilder gives 3Com users a migration path from low-end routers to high-end, high-performance routers. It is the dial-up routing that truly sets the product apart from other remote-access servers such as Shiva's LanRover and places the AccessBuilder more in line with low-end routers like the Telebit NetBlazer ST.

Other new features include upgraded client and server software for better performance, flash memory for storage of configuration information, 10BaseT support, and support for Windows for Workgroups 3.11 and NetWare 4.x. Additionally, the unit is the first remote-access unit to support the security standard proposed by the Internet Engineering Task Force (IETF) that provides interoperability between security systems from several vendors.



TWO TIMER: The AccessBuilder supports both remote client access and dial-up routing.

Even though many other remote-access products support routing, and some, such as Telebit's NetBlazer family, route multiple protocols, no other remote-access product we know of offers bandwidth-on-demand. With this feature, one 16-port AccessBuilder can

access another 16-port AccessBuilder and utilize from 1 to 16 asynchronous modem links depending on the amount of bandwidth that particular connection requires. This allows the AccessBuilder to establish high-bandwidth WAN connections without the need for expensive leased lines.

However, you can also install a digital WAN interface in the AccessBuilder to provide support for up to eight concurrent dial-in sessions as well as LAN-to-LAN connections at T1 speeds (1.54 Mbps). The two LANs can also communicate over the modem links while supporting dial-in for remote PCs.

REMOTE NODE/REMOTE CONTROL

The AccessBuilder supports simultaneous remote-node and remote-control

Continues on page NE12

► TCP/IP AND THE INTERNET

TCP/IP Navigation Made Easy

BY STEVE RIGNEY

You hear a lot about the Internet and other TCP/IP services, but you don't hear very much about the complex and arcane software you usually need to use these services. Intercon makes using TCP/IP a little simpler with TCP/Connect II for Windows, an easy-to-use TCP/IP software package with an excellent range of IP connectivity features.

TCP/Connect II for Windows is the PC version of Intercon's Mac front end, TCP/Connect II. Although this is the product's initial release, it is labelled Version 3.0: Because it is based on a portion of the code used in Frontier

Development's Super-TCP/NFS for Windows, it inherited that product's version number.

There are several TCP/IP products on the market, including Novell's LAN WorkPlace for DOS (\$400) and FTP Software's PC/TCP (\$400), but TCP/Connect II for Windows (\$500) provides a more complete set of features and ease of use for a lower total price than most. TCP/Connect II for Windows' comprehensive features offset the higher price because other products, such as PC/TCP, require extensive add-ons at additional cost to implement Network File System (NFS), file transfer protocol

Continues on page NE15

3Com Corp.

CONTINUED FROM NE11

connections from individual clients. This allows Windows users to launch a remote-control session and Alt-Tab to a remote-node session. As we expected, the remote-node connections were a bit sluggish with the AccessBuilder. This problem is endemic to all remote-node solutions because all processing is performed at the client rather than on the LAN. For example, performing a simple directory listing command for a NetWare server is instantaneous from a local client, but the same command took nearly 30 seconds from our remote client. In addition, using even a fast 14.4-Kbps analog modem can result in slow response times.

The AccessBuilder also supports remote-control connections, but requires additional software in order to do so. Currently, Microcom's LANExpress is the only remote-access server that comes loaded with both remote-node and remote-control software. For the AccessBuilder and others, you'll need to purchase Microcom's Carbon Copy, Symantec's Norton pcAnywhere, or some other remote-control software.

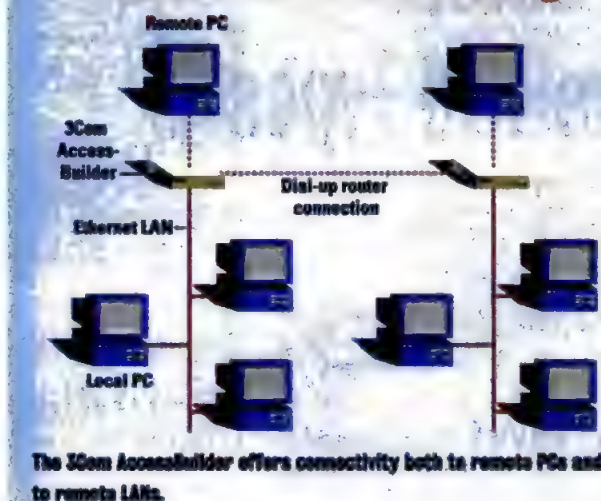
The AccessBuilder is modular in design, so changing the number of ports is easy. The AccessBuilder contains two slots, each of which can support a 4-port asynchronous module, an 8-port asynchronous module, or a digital WAN interface for T1 or E1 connectivity. LANExpress and Shiva's LanRover, on the other hand, are fixed-port units that offer no option for digital interfaces.

Configuring the AccessBuilder was a fairly simple process, thanks in large part to the quality of the documentation. First, we connected the AccessBuilder unit to our NetWare 3.11 test-bed using the single Ethernet con-

nection, which can accept AUI, coax, or 10BaseT cable.

We then had to configure each of the remote-access ports with initialization strings and other modem information. Port configuration can be completed either through an out-of-band serial con-

Remote Access and Routing



*The AccessBuilder
supports simultaneous
remote-node and
remote-control connections
from individual clients.*

REMOTE-ACCESS OPTIONS

YES = ■ NO = □	Microcom Inc. LANExpress	Shiva Corp. LanRover	Telebit Corp. NetBlazer ST	3Com Corp. Access-Builder
List price	With 8 ports and 8 28.8-Kbps modems, \$7,999	With 8 ports, \$3,499	With 10 ports, \$4,099	With 8 ports, \$4,495
Maximum number of ports	8	8	18	16
Ethernet/Token-Ring support	■	■	■	■
Multiprotocol bridge router	■	□	■	■
Dial-up routing	■	□	■	■
Dial-in/Dial-out	■	■	■	■
SNMP support	■	■	■	■
Remote management	■	□	■	■
Support for 28.8-Kbps modems	■	□	■	■
Simultaneous remote node/remote control	■	□	□	■

nection (which we used) or an in-band management console. The AccessBuilder includes initialization strings for a wide range of modems to make this configuration fairly easy. The only thing we didn't

like about the installation process was the antiquated command line interface of the setup utility. Other products such as LANExpress have more intuitive, Windows-based utilities.

Installation on the client was also a straightforward process: We just copied a

few files to the client and then ran a simple utility. The AccessBuilder utilizes scripts to automate log-ins and log-outs. The client software works with both the Open Data-link Interface (ODI) and the Network Driver Interface Specification (NDIS), the two most common network adapter drivers, and supports both the Point-to-Point Protocol (PPP) and the Serial Line Internet Protocol (SLIP), which are both used to link remote sites.

The AccessBuilder also routes NetWare's IPX traffic and bridges all other protocols. IPX routing is a particularly use-

ful capability in filtering Service Advertising Protocol (SAP) broadcast packets so that they don't bog down the modem links.

Once the client software was installed, all that we had to do was type *crlogin* to initiate a remote-node connection to the LAN. For security purposes, the AccessBuilder offers a call-back feature and prompts each dial-in user to enter a user ID and password in order to establish a LAN session. Each AccessBuilder can store up to 512 user names.

Overall, we were impressed with the AccessBuilder. Eventually, remote-access servers will all offer PC-to-LAN, LAN-to-LAN, and concurrent remote node/remote control just to stay competitive. Until then, the AccessBuilder will be part of an elite crowd.

• List price: *AccessBuilder*: \$3,495 (4-port), \$4,495 (8-port), \$6,295 (16-port); synchronous

WAN link module, \$1,000. 3Com Corp., 5400 Bayfront Plaza, P.O. Box 58145, Santa Clara, CA 95052-8145; 408-764-5000; fax, 408-764-5001.

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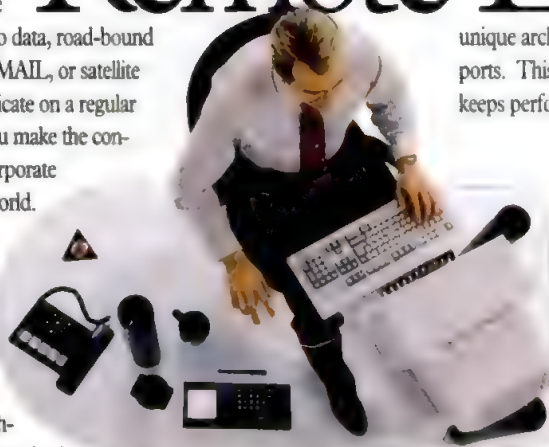
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CIRCLE 854 ON READER SERVICE CARD

CONTINUED FROM NE11

It offers complete support of both TCP/IP and NFS, the de facto Unix stan-

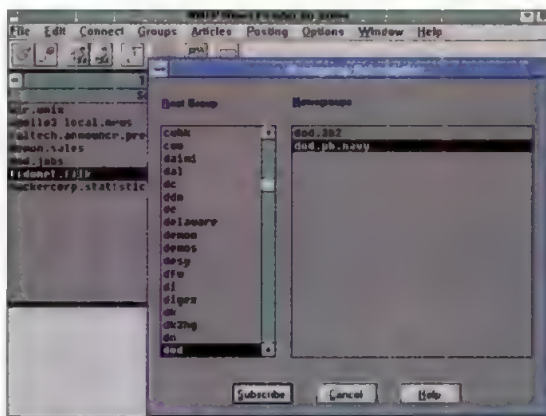
dard for sharing files and devices in multiplatform environments. The product also provides FTP support, allowing a user to send files back and forth between PCs and TCP/IP hosts, send and receive e-mail, and run basic terminal emulation. Its Internet news reader allows users to access discussion groups on the Internet. (The news reader is similar in function to a CompuServe front end such as WinCIM). Each feature comes in individual modules, and you pick the ones you need during installation.

TCP/Connect II for Windows' NFS module allows you to share your files and printers across different platforms on your local TCP/IP network. You could, for example, designate a Unix workstation's hard disk as a local drive. TCP/Connect II works with any NDIS- or ODI-compliant network adapter. You can also run TCP/Connect II for Windows in conjunction with a NetWare, Banyan VINES, Digital DECnet, or Microsoft LAN Manager network.

The FTP support is provided by both client and server modules. The server module processes transfer requests for files on your PC from other computers on the network, including other PCs running TCP/Connect II for Windows. The client module lets you transfer text and binary files to your PC from DOS, VAX, and Unix hosts. Transferring a file is easy: Select the file with your mouse and click the Copy button. Both modules offer password security.

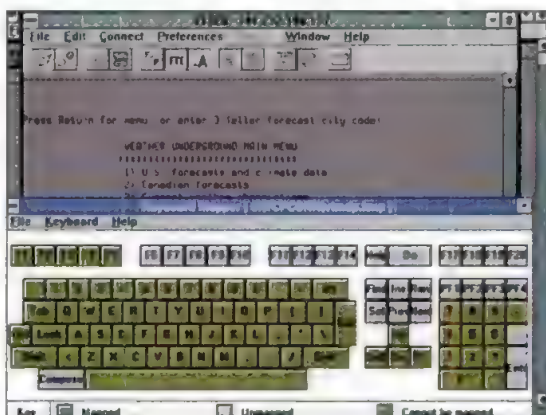
The e-mail capabilities let you send mail to anyone on the Internet. TCP/Connect II for Windows provides e-mail and news reader capabilities through

a variety of protocols, including the Simple Mail Transfer Protocol (SMTP), the Multipurpose Internet Mail Extension (MIME) to SMTP, and the Network News Transport Protocol (NNTP). SMTP is a messaging protocol



ON-LINE ENCYCLOPEDIA: You can use the news reader to find information on various topics of interest on the Internet.

used by TCP/IP networks. MIME allows you to attach multimedia files, including voice and graphics files, to your electron-



LOOKING THE PART: The terminal emulators allow you to customize your PC keyboard map to match that of a Unix or IBM terminal.

ic messages. NNTP provides access to the Internet news services.

TCP/Connect II for Windows supports a variety of terminal-emulation modes, including Digital VT320, VT220, and VT100, as well as IBM 3270 and a basic teletypewriter (TTY) to provide access to most types of mainframe and mid-range hosts. The product also supports multiple simultaneous TELNET sessions. You can customize your terminal screen and map your keyboard to

Intercon based its development of the Windows product on its TCP/Connect II, which is for Macs, and the lineage is evident: The two share nearly identical interfaces. Wollongong, on the other hand, markets several products for each platform that have little similarity.

Intercon prides itself on its technical support, and you'll probably need to test that claim when you install this product. The Windows interface makes the product easy to use, but the product can still be difficult to install and configure because of the extensive IP information required to set up TCP/IP software. During the installation, you first select the software modules to install then configure them with the correct IP address and host information, including name, address, and domain. It's not as easy as it sounds. We found Intercon's technical support staff patient, helpful, and in some cases very necessary, but you do have to make a toll call to reach them.

Once you install the product, you'll find the interface very easy to navigate, with all of the functions only a mouse click away. We used a Serial Line Internet Protocol (SLIP) connection to access the Internet and were able to send Internet e-mail and complete numerous file transfers with ease.

When it comes to TCP/IP connectivity, TCP/Connect II for Windows is a complete package. The file-transfer, e-mail, and terminal-emulation features combined with the user-friendly interface make it a strong tool for TCP/IP host connectivity and Internet access.

• List price: TCP/Connect II for Windows, Version 3.0, \$495 per user. Intercon Systems Corp., 950 Herndon Pkwy., Herndon, VA 22070; 703-709-5500; fax, 703-709-5555.

Circle 960 on reader service card

CORRECTIONS AND AMPLIFICATIONS

In our First Looks review of IBM's EtherStreamer 32 MC full-duplex Ethernet adapter (January 11, 1993, page NE15), we incorrectly referred to the 3Com Model 3C523 Ethernet adapter as a member of the EtherLink III product line.

► SMALL-OFFICE NETWORKING

Tut's Phone Wire Solution Simplifies Setup

BY O. RYAN TABIBIAN

As vendors try to make networks easier to use, Tut Systems is attempting to simplify wiring with the Silver Streak, a cabling system that allows you to use standard telephone wire—not unshielded twisted-pair (UTP)—to set up an Ethernet LAN. While the Silver Streak cannot solve all of your networking woes, it is an extremely versatile and easy-to-install wiring solution that requires no sacrifice in performance over the use of standard network cabling.

The Silver Streak is a system of transceivers and low-cost wire—RJ-11 or silver satin phone wire to be exact (hence the name)—that eliminates the need for traditional UTP Type 3 cable in an Ethernet network and runs any operating system you choose. The transceivers connect to the coaxial attachment unit interface (AUI)

port on a PC's Ethernet adapter or the AAUI (Apple's version of the interface) on a Mac's. These components are available individually or as part of bundled solutions for ISA PCs as well as NuBus and LC Macs. You can daisy-chain up to 30 nodes over a distance of 600 feet.

This is the only product we know of that supports Ethernet performance on such inexpensive cable, but it is definitely not for everyone. Although you can integrate Silver Streak clients with a larger UTP network using Tut's 10BaseT converters, this process means another piece of hardware and additional expense: These \$199 converters are twice the price of the AUI and AAUI converters.

Another feature that sets the Silver Streak apart from other simple cabling solutions—Coactive Computing's Coactive Connector and Farallon's EtherWave, in

particular—is its combination of cost and performance. At \$199 per PC connection, Coactive Connector is certainly one of the lowest-cost connectivity solutions on the market (see "Coactive Computing's Low-Cost LAN," *PC Magazine*, September 14, 1993), but it uses LocalTalk and is therefore limited to 230-Kbps transmission speeds, while the Silver Streak can handle standard 10-Mbps Ethernet speeds. The EtherWave supports standard Ethernet (see "Farallon Simplifies Network Setup," *PC Magazine*, February 22, 1994) but requires Type 3 UTP cable.

Since the choice of cabling media should not seriously affect network performance, we did not expect to see any difference in performance between the Silver Streak and a UTP setup—and we didn't. Our tests showed that the Silver Streak's RJ-11 connections supported the same volume of traffic as a standard 10BaseT Ethernet network. The overall network performance was identical to that of our baseline configuration—a 10BaseT star setup: a peak throughput of around 8 Mbps on four-client tests using 4K block sizes. Also, we saw no evidence of retransmissions, often an indication of weak cabling.

The Silver Streak's RJ-11 cable offers two other benefits: availability and familiarity. Unlike Type 3 UTP cables, which are typically available only from mail-order houses and network integrators, phone wire can be bought just about anywhere. Phone wire is also more familiar to most users than UTP or other cables, so most won't have to be instructed in how to connect the wires.

While EtherWave can fit seamlessly into a corporate Ethernet LAN and support a robust NOS such as NetWare 3.x, the Silver Streak is primarily a small office solution that would combine well with LANtastic or Windows for Workgroups.

Still, if you need low-cost, easy-to-use network cabling, the Silver Streak is the obvious choice. It combines standard Ethernet speed with low cost and easy setup.

• List price: *Silver Streak*, \$199 (ISA); \$249 (NuBus or LC); transceivers, \$99. Tut Systems, 2446 Estand Way, Pleasant Hill, CA 94523; 510-682-6510; fax, 510-682-4125.

Circle 962 on reader service card

■ Building a Better Balun

In order to make a product that supports Ethernet connections over silver satin phone wire, Tut Systems had to address two distinct—though related—problems: making the actual connection to both the AUI and AAUI ports and minimizing the effect of interference, to which the low-grade wire is prone. Solving both problems requires the services of a device known as a *balun*.

A balun (short for balanced/unbalanced) allows you to connect a balanced cable to an unbalanced cable. A cable is balanced when each of its conductors can handle equivalent signals. Twisted-pair cable is balanced because its conductors are identical wire pairs. Coax cable is unbalanced because its conductors are the wire and the shielding and the shielding does not possess the same signal-handling capacity as the wire.

The Silver Streak transceivers (connectors) are equipped with

baluns so that they can connect the (balanced) phone wire to the AUI/AAUI port, which is designed for (unbalanced) coax connections.

Once the physical connection has been established, the challenge of overcoming interference becomes critical. Silver satin wire is prone to interference mostly because its two wires are unshielded and run in parallel rather than twisting around each other, which would provide a limited amount of shielding.

The quality of the balun affects the signal-to-noise ratio of the physical connection. Where a typical high-grade balun offers a signal-to-noise ratio of 100:1, Tut Systems' patented balun provides a ratio of 10,000:1.

Simply put, Tut Systems tackled the challenge of making a connection clean enough to support Ethernet over unshielded, untwisted wire by inventing a better balun.

—By Michael Ryan

KING AMONG PEERS

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SCOREBOARD					
Comparing peer-to-peer LANs		Artisoft Inc. Simply LANtastic 5.1	Microsoft Corp. Windows for Work- groups 3.11	Novell Inc. Netware 3.11	Performance Technology Inc. PowerLan 3.0 for Windows
PCWEEK LABS Overall score		3.2	3.5	3.5	4.0
Ease of installation and use (20%)		4.5	4.0	3.5	4.5
Quality of security and administration tools (20%)		4.0	2.0	4.0	4.5
Quality of data- and re- source-sharing tools (20%)		2.5	3.5	3.5	4.0
Interoperability (20%)		1.5	4.0	4.0	3.5
Performance (20%)		3.0	4.0	2.5	3.5

February 7, 1994

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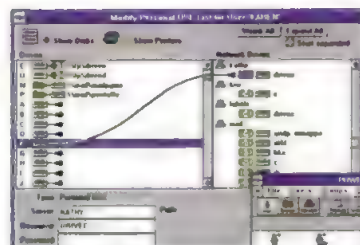
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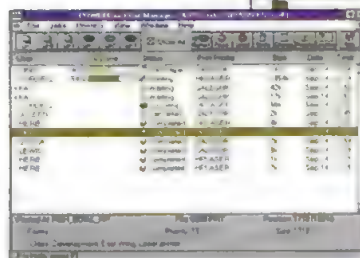
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cause you can carry clear signals over lower grades of wiring, complete re-wiring of the building is unnecessary.

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CIRCLE 874 ON READER SERVICE CARD

► WIRELESS NETWORKING

Sharing Files (and Printers) Over the Airwaves

BY STEVE RIGNEY

Just when you think your network is perfect, someone needs a PC or a printer in a spot that's hard to wire. Instead of killing yourself in an attempt to get cable to the offending node, try ALPS Electric's RadioPort Plus wireless network adapter. Though it offers slower transmission speeds than most other wireless adapters, it is less expensive, supports greater distances between nodes, and is the first wireless adapter that can also function as a print server.

The RadioPort Plus (\$499) is a small external adapter that attaches to the parallel port of a networked PC or printer and establishes spread-spectrum radio links between that device and others in a Microsoft Windows for Workgroups (WfWG), Artisoft LANtastic, or Personal NetWare peer-to-peer LAN. Using the RadioPort Plus, you can also connect PCs and printers to a NetWare 2.x or 3.x file server by installing a compatible wireless adapter in the server. (The vendor recommends Proxim's RangeLAN.)

The price may seem high, but it is lower than that of other wireless adapters—such as Windata's \$1,030 FreePort Transceiver—and a lot lower than the cost of the difficult cabling job you were trying to avoid in the first place. The RadioPort Plus is also less expensive than Proxim's \$595 RangeLAN2 wireless adapter.

ALPS kept the cost down by utilizing a low radio frequency that requires less-expensive hardware. Windata uses frequencies above 2 GHz and Motorola's Altair Plus II uses licensed frequencies around 18 GHz. Since lower frequencies travel farther, the RadioPort Plus also operates over a greater distance than higher-frequency products (about 800 feet), such as the Windata FreePort (260 feet) and the Altair Plus II (40 to 130 feet).

The trade-off is in performance: The RadioPort Plus' low-frequency signal sup-



RADIO STATION:
RadioPort Plus is
a network adapter
and a print server.

ports only AppleTalk speeds of 230.4 Kbps, which are acceptable for small file transfers and e-mail but too slow for transferring larger files and running network applications. Other vendors, including Xircom and NCR, are developing radio-based wireless PCMCIA adapters that will support up to 2-Mbps throughput, while more expensive products such as the FreePort and the Altair Plus II support throughput near 5 Mbps.

During setup, you configure each RadioPort Plus to perform as either an adapter or a print server. The print server capability is unique because other wireless products require standalone print servers in addition to wireless adapters to provide printer sharing. The RadioPrint software included with each adapter is a DOS TSR that runs on the networked PCs and allows them to send print jobs to a RadioPort Plus attached to a standalone printer. You can assign different RadioPort Plus printers to each local LPT port, allowing you to use multiple printers. Unlike standalone print servers, the RadioPort Plus does not utilize a buffer, so large print jobs will tie up your PC if the printer is already busy. You can overcome this problem by dedicating a PC as a print server and linking it to the printer with RadioPort Plus. However, if you typically print large documents or graphics files, you'll probably be better off with a buffered print server.

RadioPort Plus adapters can be used to connect PCs and printers to a wired peer-

to-peer LAN or to establish a complete wireless peer-to-peer network. RadioPort Plus includes proprietary client drivers for WfWG, LANtastic, and Personal NetWare, but it does not support the Network Driver Interface Specification (NDIS), one of the most popular drivers supported by other LANs, such as Performance Technology's PowerLan. Also, if you need to connect a PC to your wired NetWare network, you will have to install a NetWare-compliant, RadioPort-compatible wireless LAN adapter in your file server. The vendor recommends the RangeLAN or RangeLAN2 because both work with NetWare servers and—more importantly—they use the same frequency as the RadioPort Plus (in the 902-MHz range). RadioPort Plus adapters can communicate directly with a RangeLAN adapter in the NetWare server to provide a wireless connection for your PC.

The RadioPort Plus provides a high level of reliability by utilizing three different radio channels in the 902-MHz range, allowing you to switch devices to a different channel if one channel is subject to interference from other devices, such as alarm systems, using similar frequencies. However, users can only access other RadioPort Plus devices on the same channel as their own. Alternatively, you can set up different workgroups on each channel to help guarantee greater access.

The RadioPort Plus provides a menu-based installation utility with which you configure each adapter and load the drivers for your particular network. The utility allows you to select and change your radio channel. The program also scans the RadioPort Plus and alerts you to any problems. In addition to the standard AC adapter, each unit includes a power cable that allows you to connect to the keyboard connector on your laptop.

The RadioPort Plus is not the fastest wireless product on the market, and it isn't the most capable print server, either. It is affordable, though, and versatile, and those two factors make it an excellent solution for small peer-to-peer LANs with demanding wiring requirements.

• List price: *RadioPort Plus*, \$499. ALPS Electric, 3553 North First St., San Jose, CA 95134; 408-432-6000; fax, 408-432-6035.

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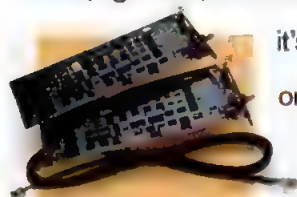
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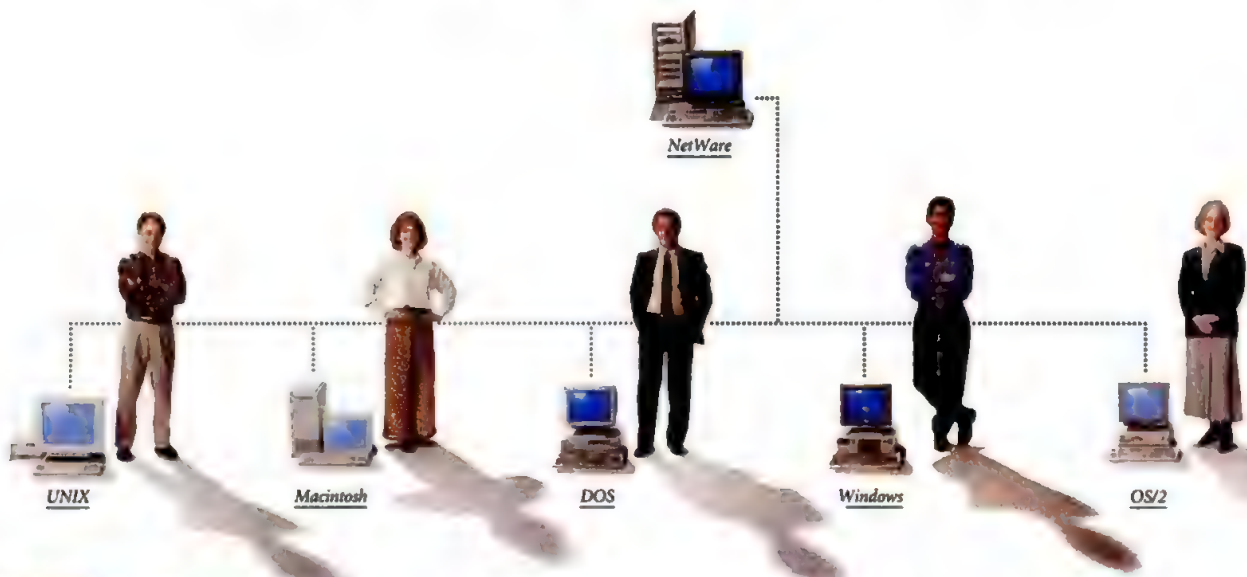
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► PROTECTING YOUR LAN

Fault Tolerance for the Rest of Us

BY JEFFREY D. BAHER

On most LANs, downtime is costly, and the alternative is no better: Using the most complete fault-tolerant NOS, Novell's NetWare 3.11 System Fault Tolerance III (SFT III), can more than double the cost of your LAN. Vinca offers StandbyServer, a NetWare add-on combined with two adapters, as a compromise. It minimizes, but does not eliminate, downtime and is substantially less expensive, though it requires purchasing NetWare. However, since it doesn't eliminate downtime entirely, it is unsuitable for some network environments, such as hospitals, that absolutely cannot go down.

StandbyServer utilizes proprietary high-speed (80-Mbps) serial adapters to connect a server and its backup (secondary) server. The software is a DOS application (STANDBY.EXE) that runs on both servers and allows NetWare's built-in disk mirroring capabilities to duplicate the primary server's hard disk data onto the secondary server. StandbyServer supports both NetWare 3.x and 4.x and does not require that the two servers be identical. On the other hand, SFT III is an enhanced version of NetWare 3.11 and does not yet support NetWare 3.12 or 4.x. Also, SFT III requires that the two servers be identical.

Designed to eliminate downtime, SFT III uses a 100-Mbps fiber link and mirrors both the RAM and the hard disk. If the primary server goes down, the secondary server immediately takes over.

Despite the security that SFT III provides, it is not for everyone. Its price ranges from \$2,595 for a 5-user license to \$18,995 for a 250-user license. SFT III also requires an additional investment of \$2,000 to \$3,000 for the fiber adapters and cable plus the purchase of two identical servers. For many, the costs of implement-

ing SFT III far outweigh the benefits. StandbyServer targets those environments specifically.

With StandbyServer, the network administrator manually switches over from the failed server to the secondary by stopping STANDBY.EXE and launching NetWare on the secondary. The network is brought back up and the failed server can be repaired.

StandbyServer does not mirror the server's RAM and therefore does not offer the same level of protection as SFT III. The information in server RAM, such as loaded NLMs and disk cache data, will be lost if the primary server fails.

Establishing a connection took only a few steps. First we installed the serial adapters in each machine and connected them with the serial cable provided. These cards are available for both ISA and EISA PCs. Both machines should have all necessary NetWare files and executables loaded. Only one NetWare license is necessary because only one version of NetWare is running at any given moment. This process was painless thanks to Vinca's excellent documentation.

We ran three simple tests on the primary server to test fault tolerance: We cut the power, pulled the LAN connection, and executed the NetWare DOWN command. In all three cases, restoring the network was as simple as typing the two necessary commands on the secondary server.

StandbyServer is not a fail-safe solution for fault tolerance, and it does not challenge SFT III in the high-end market. But it is easy to install and provides good protection from data loss. Best of all, it's affordable.

• List price: StandbyServer, \$1,695 (ISA); \$1,995 (EISA). Vinca Corp., 4000 Central Park East, 1815 South State St., Orem, UT 84058; 801-223-3100.

Circle 963 on reader service card

HOW THEY COMPARE

NetWare 3.11 SFT III	StandbyServer
Expensive	Moderately priced
Includes NetWare 3.11	Requires purchase of NetWare
Eliminates network downtime	Does not entirely eliminate downtime
Mirrors server hard disk and RAM	Mirrors server hard disk only
Requires identical servers	Hardware-independent
Supports NetWare 3.11 only	Supports NetWare 3.x and 4.x

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Feature Comparison

	Advanced Battery Management	High Protection Warranty	Current USA PC Magazine Editors' Choice	High Voltage Regulation
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APC	No	2 Years	No	No



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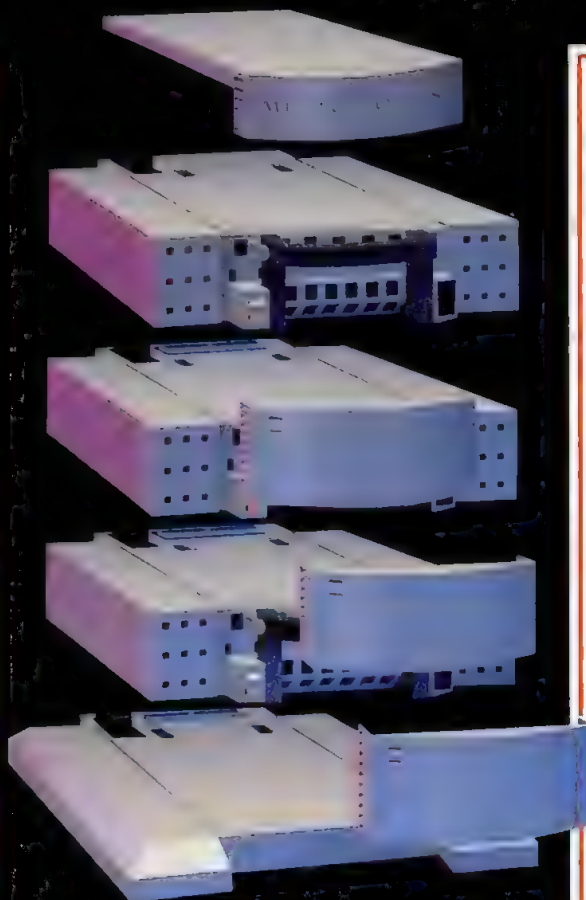
RAIDION LT and LS Series disk array subsystems are designed for use with either Novell NetWare 3.1x/4.x or IBM OS/2.

MIRROR RAIDION can be configured with 2 modules to provide mirrored fault tolerance up to 3 GB.

RAID 5 Adding one module to a mirrored subsystem and installing RAIDWARE™, doubles the user capacity by converting the mirrored array to RAID 5. Under OS/2, the maximum configuration is 28 modules. Under NetWare, RAIDION can be expanded to 32 modules per array with a capacity of 93 GB.

Exceptional Warranty

Micropolis offers a full five year parts and labor warranty on its entire line of high-capacity disk drives. Other RAIDION subsystem components have a three year warranty.



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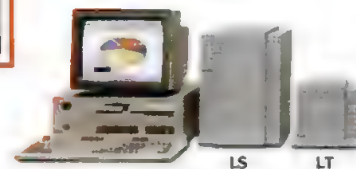
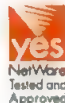
Reliable RAIDION can be configured with an on-line spare module that activates automatically upon a drive failure, ensuring continued fault-tolerant operation without human intervention. Hot-Swap and Hot Replacement features allow RAIDION to be serviced while your network remains in operation.

Award Winning In a benchmark comparison of arrays, Corporate Computing said: "Raidion was our overall winner with an impressive combination of high performance, low cost, and unparalleled expandability." May 1993. RAIDION was also named LAN Magazine's Disk Array Product of the Year for 1994.

Economical An LT Series three module 2 GB array is only \$6,585. An LS Series Raid 5 array with a capacity of 6 GB lists for \$12,825. That's just \$2.12 per MB. It's no wonder Byte Magazine said: "RAIDION's low price alone makes it worth considering." August 1992



RAIDION LT can be stacked up to seven modules high for convenient desk top use.



MODULE #	CAPACITY	DRIVE FORM
LM 1050	1,050 MB	LT 3.5-inch
LM 1760	1,760 MB	LT 3.5-inch
RM 2100	2,100 MB	LS 5.25-inch
RM 3020	3,020 MB	LS 5.25-inch

Other add-on module capacities available.

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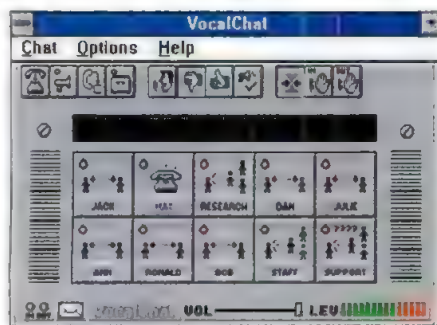
NEWS OF ANNOUNCED NETWORK PRODUCTS AND UPGRADES

by Vicki B. Jacobson

NEW

Windows Users Get Chatty

The VocalChat WAN System, VocalTec's new intercom/phone mail system, may give partial relief from large phone bills. It uses compression to provide up to 1,000—not



CALLING ALL PCS: VocalChat WAN turns your PC into a phone mail system.

standard .WAV file (Windows sound file) or 13-bit PCM .WAV file and transmitted over the network to a recipient's PC, where it is either answered or saved as a voice-mail message.

• List price: *VocalChat WAN System, pricing to be announced. VocalTec Inc., 157 Veterans Dr., Northvale, NJ 07647; 201-768-9400.*

Circle 955 on reader service card

NEW

NetWorth Flexes Its Muscles with New Hub

A hub isn't just a hub anymore. Vendors are packing as much network hardware and software as they can into one unit. For NetWorth this means integrating a combination of 100-Mbps technologies, an embedded server, switching, routing, and WAN connections. The 10-slot Series 6000 PowerBuilder Switching and Network Services Hub with the Network Services Engine (NSE) attempts to tackle the combined needs of your department, workgroup, and remote office networks.

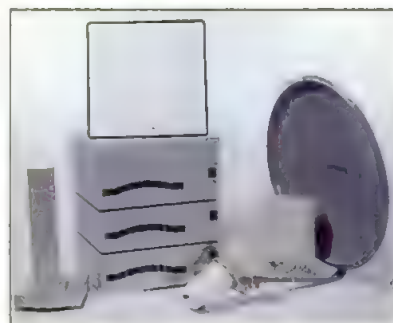
The PowerBuilder hub works with your current network to allow modules to be hot-swapped between it and NetWorth's modular hub, the Series 4000. It also offers an upgrade path to high-speed networking technologies with dual backplanes. One backplane supports up to 30 10BaseT Ethernet segments and 10 Token-Ring segments, while the PowerPlane High-speed Backplane Upgrade (NetWorth's backplane that supports up to 2 gigabits) offers connectivity for 100-Mbps Ethernet, 100-Mbps FDDI, 100-Mbps AnyLan (HP's proposed fast Ethernet technology, formerly called 100Base-VG), or ATM networks.

• List price: *Series 6000 PowerBuilder Switching and Network Services Hub with the Network Services Engine, \$7,995; PowerPlane High-speed Backplane Upgrade, \$995. NetWorth Inc., 8404 Esters Blvd., Irving, TX 75063; 214-929-1700; fax, 214-929-1720.*

Circle 952 on reader service card

HOT PROSPECT

AirPort: Wireless for Internetworks



Why use your average slow phone line to link your offices when you can use Windata's AirPort Wireless Interbuilding System to give you lots of speed at low prices? It features long-range transmissions for building-to-building wireless networking. Windata first entered the wireless market with an in-office product, the FreePort Wireless LAN System. AirPort provides connections for up to five different locations through point-to-point and point-to-multi-point connections.

The AirPort System comes in two different models. AirPort I connects sites up to 1,000 feet apart and AirPort II extends the range to 1.8 miles. Each model includes a wireless hub with an indoor antenna (AirPort II also includes an outdoor antenna) and one or more wireless remote units.

• List price: *AirPort Wireless Interbuilding System: AirPort I, \$12,450; AirPort II, \$22,000. Windata Inc., 10 Bearfoot Rd., Northboro, MA 01532; 508-393-3330.*

Circle 957 on reader service card

IMPROVED

3Com Adds Bulk to LinkBuilder

Welcome to the latest craze in the hub market: developing a "superhub." 3Com Corp.'s enhanced LinkBuilder MSH (Multi-services Hub), like SynOptics' LattisSystem 5000 and Cabletron's MMAC Plus, attempts to address your advanced networking needs: improved performance and server access, flexibility, and cost-effectiveness. 3Com's answer lies in enhanced switching, additional FDDI support, and advanced Token-Ring features.

LinkBuilder MSH now features LinkSwitch, an Ethernet-to-FDDI switching module for up to nine segments. Optional FDDI concentrator modules provide high-speed networking as well as a migration path to 100BaseT and ATM. And for Token-Ring users, 3Com offers the Token-Ring Advanced Multistation Access Unit (MAU).

• List price: *LinkBuilder MSH*, \$3,195; *LinkSwitch*, \$7,200; *FDDI concentrator modules*, \$3,195 to \$3,955; *Token-Ring Advanced MAU*, \$1,695. 3Com Corp., 5400 Bayfront Plaza, P.O. Box 58145, Santa Clara, CA 95052-8145; 408-764-5000.

Circle 954 on reader service card

NEW

ShareIt Eases Network Congestion

How do you accommodate the growing number of users on your network? One answer may be ShareIt, a hardware/software switch from NHC Communications, formerly Mux Lab. Sharing network resources such as gateways, routers, and bridges is only one of the

functions it offers. Share-

It also allows network managers to control the physical configuration of these resources remotely from a Windows-based PC.

ShareIt is a matrix switch that features 24 bi-directional ports for a total of 48



SPREADING IT

AROUND: ShareIt allows you to share network resources.

segments. The switch has a capacity of up to 240 Mbps. It supports Levels 4 and 5 unshielded twisted-pair cabling. And, as your network grows, ShareIt can be daisy-chained together for more connections.

• List price: *ShareIt*, \$2,000. NHC Communications, 5450 Cote De Liesse, Mount Royal, Quebec, Canada H4P 1A5; 514-735-2741; fax, 514-735-8057.

Circle 953 on reader service card

IMPROVED

Horizons Offers More than Just Shadows

No one wants to lose data. Some vendors, such as Horizons Technology, are making sure you never do by mirroring your data. LANshadow, Version 4.0, prevents the data loss and network downtime associated with file-server failures, by copying the information from a primary server to a backup server. While vendors such as Vinca Corp. offer a hardware/software product (the \$1,695 to \$1,995 StandbyServer), Horizons' product is software only. Version 4.0, with its Windows interface, is easier to use. Previously, LANshadow let the user run mirroring activities continuously or select start and stop times. This latest version adds selective mirroring: the ability to skip open files. LANshadow runs as a NetWare Loadable Module for NetWare 3.x or 4.x.

• List price: *LANshadow, Version 4.0*: first server pairing, \$995; additional servers, \$395. Horizons Technology, 3990 Ruffin Rd., San Diego, CA 92123-1826; 800-828-3808.

Circle 951 on reader service card

BRIEFS

SWITCHES

SynOptics Communications will offer a standalone switch for linking your LAN to ATM backbones. The EtherCell switch gives new life to the LattisSwitch 3000, providing the wiring closet hub with connections for its Ethernet segments to a high-speed backplane. It also fills the middle ground between the 3000 and SynOptics' high-end LattisSystem 5000 hub. The switch features one ATM port for 155-Mbps throughput and 12 10BaseT ports. The EtherCell is available in two versions: The ATM multimode fiber model is \$9,995, and the Category 5 unshielded twisted-pair version is \$9,495. 800-776-6895, 408-988-2400.

Kalpana has cut the price of its five-port EtherSwitch by almost half. The EtherSwitch EPS-500 10BaseT Accelerator dropped from \$3,500 to \$1,995. The switch supports throughput rates up to 20 Mbps in half-duplex mode and 40 Mbps in full-duplex mode. 408-749-1600; fax, 408-749-1690.

Cascade Communications Corp. is also attempting to lower the price of switching by implementing Frame Relay Switched Virtual Circuit (SVC) technology in its switches. Frame relay is a high-speed packet-switching technology for WANs. SVC is a type of frame relay service for establishing connections to the network. It lowers costs by only allocating bandwidth as it is needed. This differs from Permanent Virtual Circuit (PVC), the more common technology, because as its name implies, PVC requires permanent allocated bandwidth. Frame Relay SVC will be an optional software feature: \$5,000 for the STDx 3000 or STDx 6000; \$10,000 for the B-STDx 9000. 508-692-2600.



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Adding value to your network

NEW

Xylogics Serves Up Remote Connectivity

Recognizing that remote access is more than a passing trend, Xylogics attempts to accommodate remote users by offering them the same level of transparent connection that they expect from within the office. MicroAnnex NCS is a dual-port remote networking server that attempts to address all the needs of remote users by providing dial-in, shared dial-out, and dial-up routing capabilities. The dual-port unit also comes with Fastlink software. Fastlink lets the user dial into the network.

• List price: *MicroAnnex NCS*, \$995. *Xylogics Inc.*, 53 Third Ave., Burlington, MA 01803; 800-889-9229, 617-225-3317; fax, 617-273-5392.

Circle 959 on reader service card

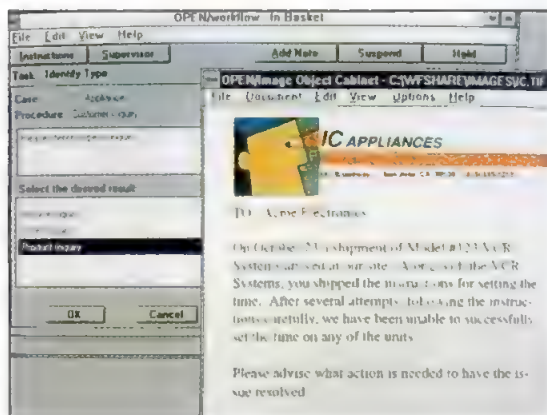
NEW

Wang Helps Users Work It Out

Wang Laboratories helps users develop and implement workflow procedures without extensive scripting or programming. The company extends its line of work-management software with the introduction of OPEN/workflow. OPEN/workflow software lets users create, automate, manage, and integrate work flow procedures into their networked PC and Unix applications. OPEN/workflow is a client/server application that comes with a set of tools including a graphical user interface, an application programming interface for use with Microsoft Visual Basic and Powersoft's PowerBuilder, and reporting tools for developing work flow procedures.

• List price: *OPEN/workflow*, \$7,500. *Wang Laboratories Inc.*, One Industrial Ave., Lowell, MA 01851; 508-459-5000; fax, 508-967-4152.

Circle 956 on reader service card



GETTING IT TOGETHER: OPEN/workflow helps automate and manage workflow procedures.

NEW

XNET Unleashes Additional Ethernet

Tired of dealing with overloaded networks? Well, XNET Technology offers to solve the problem with its Series 1800 ParallelSwitch ServerHub switching hub card. The server-based hub card adds six new Ethernet ports to an existing server for up to 60 Mbps of total throughput. Having the hub card located within the server allows the card to interface directly with the server's bus; response times are shorter and network bandwidth is increased. Each port can be assigned to a specific device or to another server entirely. The hub card comes in 10BaseT or BNC versions for ISA or EISA buses. Series 1800 is designed for NetWare environments, and it supports SNMP for remote management.

• List price: *Series 1800 ParallelSwitch ServerHub: ISA/10BaseT version*, \$2,488; *ISA/BNC version*, \$2,688; *EISA/10BaseT version*, \$2,988; *EISA/BNC version*, \$3,288. *XNET Technology Inc.*, 426 S. Hillview Dr., Milpitas, CA 95035-5464; 800-788-0148, 408-263-8888; fax, 408-263-8898.

Circle 958 on reader service card

BRIEFS

NETWORK MANAGEMENT

Frye Computer Systems' latest version of its Utilities for NetWare software offers users more control of critical NetWare functions. Users can edit and update NetWare printing and administration utilities such as SYSCON and PRINTCON. Version 2.0 (\$495) has over 100 new features, including additional capabilities for troubleshooting and supporting your NetWare LAN. The upgrade also lets users copy configuration information across servers. 617-451-5400.

The LAN Support Group announced enhancements to its BindView NCS (Network Control System). Version 3.5 features enhanced analyzing capabilities for NetWare LANs and both hardware and software auditing tools. The new Enterprise-Wide Reporting feature, part of the NCS Console, provides additional documentation and analysis by generating reports that span multiple file servers. Enhancements were also made to each of the current modules, including the addition of support for VINES, Microsoft LAN Manager, and OS/2 LAN Server clients in the Workstation Auditing Module. 713-789-0882.

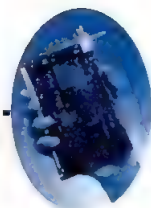
Brightwork Development recognizes that it is becoming increasingly important to network administrators for management to encompass all users, whether they are in the office, on the road, or at home. So, it released enhancements to its NET-remote+ remote-support trouble-shooting utility. Version 5.2 (\$699 for 100-user file-server license) supports up to 1,000 nodes from a remote location. NETremote+ 5.2, features multiple levels of security, including passwords and NetWare group restrictions. 908-530-0440.



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CIRCLE 682 ON READER SERVICE CARD

Superhighway: Interstate or Dirt Road?

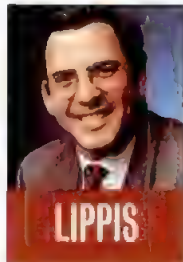
We sit poised on the edge of an age of great innovation in which the convergence of computing, telecommunications, and cable television technologies, services, and industries will give rise to interactive TV and multimedia communications. The highly touted superhighway will be their transport vehicle.

Or so we've been told. But without a clearer directive from the Clinton administration for the regulatory and legislative architecture, the information superhighway will remain little more than a concept. Sure, there is the Internet, but it lacks bandwidth, ease of use, security, and governance. The cable companies and telecommunications companies will probably build some kind of information network, but it will be costly and lack the universal access needed to fulfill the vision's promise.

Here's the problem: The Clinton administration is striving for two mutually contradictory goals. First, it wants to build the information superhighway with private—not government—funds. A noble goal, considering that federal funds are lacking even for new social programs, let alone for a superhighway that will cost in excess of \$200 billion. The administration also wants to ensure universal access: providing everyone—not simply those who can afford it—access to the wealth of information that will be on the national information network. And this, too, is socially responsible: Networks will develop the critical mass of users they need to be effective communication tools. But universal access is largely incompatible with a high-risk, competitive environment that developing the net with private funds will create.

While universal access is touted in Washington, it has not been mandated. If this condition persists, information conglomerates will focus their attention on high-density metropolitan areas to maximize their chances of profit and survival. Firms are catapulting themselves into information conglomerate status either to make its enforcement nearly impossible or to prolong its implementation. The longer Washington waits before it offers a comprehensive framework for the information sector of the U.S. economy, the less universal access may be assured.

Yet while competition controls costs and stimulates innovation, it will also result in vendors wanting to form their own superhighways as they look



to differentiate themselves. And there's the rub. No single company can afford to duplicate network infrastructure on the scale of a superhighway. This is especially true now with the recent Federal Communications Commission decision to lower cable rates by some 7 percent. This action will reduce the cable industry's cash flow by over \$1 billion per year, lowering profits while simultaneously increasing the barrier of entry into information conglomerate status for cable companies. This

FCC rule is widely believed to be a major contributor to the failure of the Bell Atlantic-TCI merger.

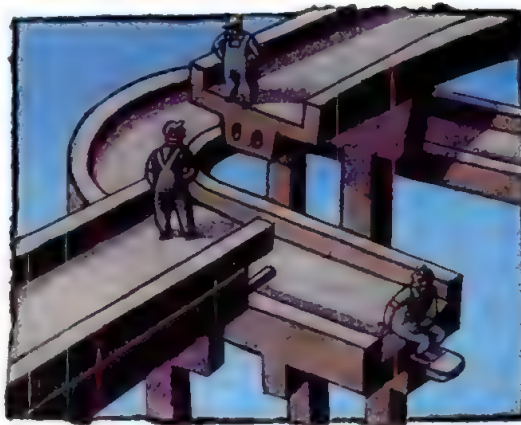
MANAGED COMPETITION

One potential solution may be to borrow some of the concepts of the administration's health care reform program, which calls for both universal access and managed competition.

Can a managed competition model work within the information sector? Large information conglomerates comprising cable companies and telecommunications companies would be formed on a national level. Consumers would be guaranteed access to the information network, and competition would keep prices low and innovation high. The government would then be in the business of creating an industrial policy for information services, picking and choosing winners and losers.

The government will have to regulate the access, usage, and services of this national network. If Washington is unable to act, then the nation's large metropolitan areas may be blessed with competitive information-rich services at a low cost while its rural areas are stuck with high tolls and the bumpiest of access lanes on the superhighway.

For the convergence of these industries to be a truly national competitive asset, we need a debate of the issues resulting in an overall regulatory and legislative plan. I encourage all participants to engage in the debate by letting us know at *PC Magazine* what your concerns and hopes are for the emerging convergence. Don't get stuck on some super-dirt path that gives you more limited access than what you really need. Get involved. □



Without a clearer directive from the administration, the superhighway will remain a mere concept.

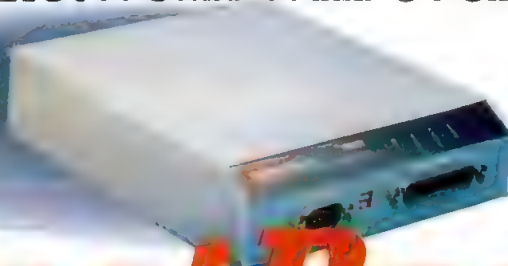
NICK LIPPIS is a contributing editor for *PC Magazine* and is president of Strategic Networks Consulting, a consultancy specializing in enterprise networking. He is also publisher of *The Internetwork Advisor*, a monthly newsletter.

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CIRCLE 879 ON READER SERVICE CARD

Novell's Place on the Highway

Amid all the hubbub around the information super-highway, Novell has been conspicuously absent. But don't be fooled. Novell is certain to play a part in building a national data network that would enable companies to collaborate much in the way individuals on a LAN do. Here's how.

There are four check-off items on the "to do" list before this national network becomes a reality. First, you need to be sure that all users connecting to this national data network have unique addresses. Second, once connected, users need to be able to locate the available resources. Third, there need to be resources on the network for users to locate. Fourth, management and security facilities need to be in place to guarantee smooth operation.

Novell is tackling all of these issues. It has begun to compile a database of all IPX addresses currently in use. The Novell

Network Registry, as it is called, Frank, will let companies link their networks together, basically to create one big IPX-based Internet.

There are robust services in NetWare 4.0. With these services there can be a single repository of all networked objects that developers can quickly access no matter where the objects may lie. Certainly there's plenty that Novell can do to beef up Novell Directory Services (NDS), but work is under way.

The network objects may include any number of things, including multimedia services like Video for NetWare and Novell's telephony services developed with AT&T.

Developers will be able to use these services to deploy complex distributed applications rapidly. AppWare, Novell's application development environment, allows developers to add networked services quickly to their applications by calling other vendor-created objects. Reusable objects make building networked applications far simpler.

Finally, for the management aspect, Novell has deployed management agents within NetWare servers. This enables you to gather crucial information.

There are some other interesting potential "highway" items in Novell's product suite, not the least of which is a possible embedded operating system that would be used for running home appliances like VCRs and toaster ovens. Connecting these onto a network would offer even more possibilities. I don't think Novell is going to sit this one out, Frank.



GREENFIELD:

The embedded OS for running home appliances is an interesting potential "highway" item in Novell's product suite.

W

ow, a big swing and a miss! I felt the breeze from that one way over here, David. An "IPX-based Internet"? Talk about the tail wagging the dog!

First of all, IPX is just one piece of Novell's tightly integrated protocol stack. If you want to prepare the whole package for internetworking, you have to address other areas like the NetWare Core Protocol (NCP) too. Novell's NetWare Burst Mode feature, often mistakenly identified as an IPX enhancement, tries to polish up NCP so it works economically across expensive and traffic-sensitive inter-LAN links.



DERFLER:

Despite the polishing, IPX will never be an IP. IP was conceived and incubated for internetworking. It's as fast as it practically can be while still being rugged. IP products were purified first by Department of Defense certification and then by intensive

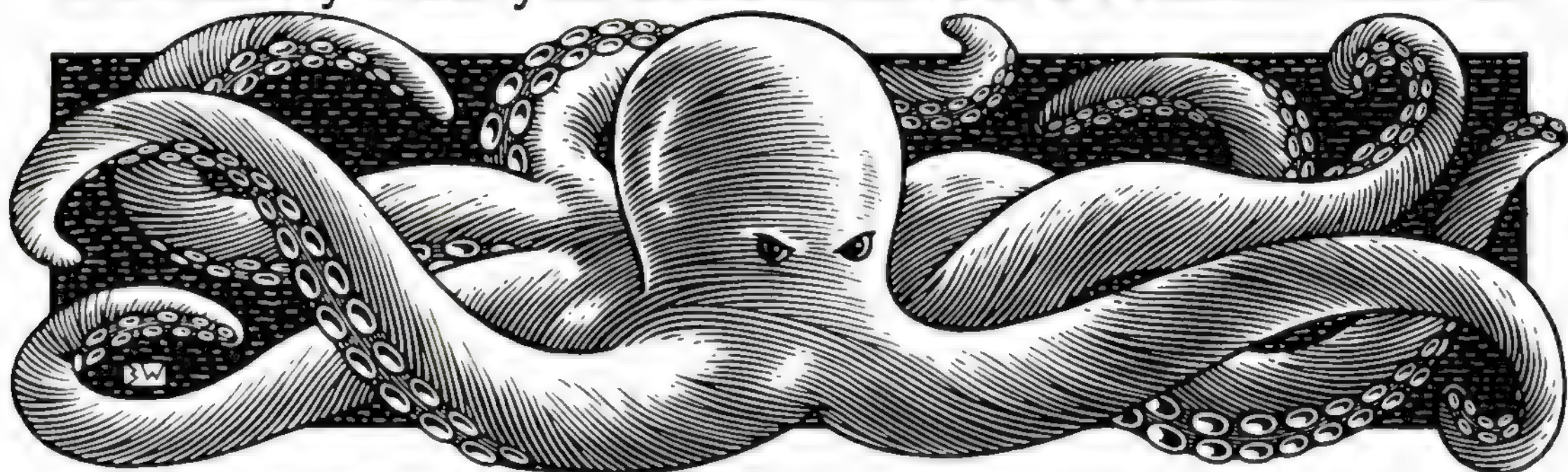
peer and market pressures. Products from different companies interoperate.

Novell's IPX is small and fast because it doesn't carry the assured delivery mechanisms needed on a big internetwork. Specifically, it relies on higher-level protocols to reassemble packets. The Burst Mode helps efficiency, but only under perfect connection conditions, and Burst Mode has had many compatibility problems.

In contrast to TCP/IP, IPX products have significant up-front costs in terms of both the money and time it takes for vendors to get their IPX products certified by Novell. Then there's the Novell Network Registry, which is aimed at giving companies a nonconflicting way to link LANs over public data carriers. Private companies have to pay to get a subnet number from the Novell Network Registry. Now there's a way to leverage IPX! Once you get the compatible products and subnet, where's the backbone? Where are the millions of routers, leased lines, and access processors needed to make a real "internet"?

While you were dreaming about NetWare in your toaster, Novell delivered NetWare/IP and loaded TCP/IP protocols into the latest release of the NetWare client software. NetWare/IP is NetWare over TCP/IP without IPX. There's the arrow pointing in the right direction. By the way, the NetWare Burst Mode works well over TCP/IP too. So why bother with IPX? When a network architect needs a serious management internetwork, TCP/IP is the path to practical and reliable service.

It's exactly what you need in network remote control.



Here's help for every network administrator who needs to be in more than one place at a time. Or do several things at once. It's called Proxy, and it's the high performance network remote control software that not only works with Windows, it works from Windows. Which is important because, unlike other remote control software, Proxy lets you connect to a number of PCs simultaneously, putting each in its own window. So you can

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reconfigure one machine, run diagnostics on another, and provide help to a user on a third. You can even off-load processor intensive tasks to an idle PC elsewhere on the network. Call now and learn how to try Proxy free for 30 days. See for yourself how Proxy can give you the helping hands you need.

1-800-828-4146 Ext. 13 (US & Canada)

**FUNK
SOFTWARE**



System Requirements: Proxy "Master" runs in Windows and can control multiple "Hosts" running DOS or Windows over an IPX network (e.g. NetWare). Proxy is a trademark of Funk Software, Inc. © 1994 Funk Software, Inc., 222 Third Street, Cambridge, MA 02142 Tel (617) 497-6339 Fax (617) 547-1031. Developer tested only. Novell makes no warranties with respect to this product.



CIRCLE 870 ON READER SERVICE CARD

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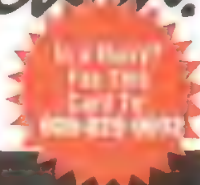
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User-to-User

BY NEIL J. RUBENKING

A Bug in the Windows Undelete Program

There's a bug in the Windows version of the DOS 6.0 UNDELETE program. If you try to undelete a file and another file with the same name already exists, the program prompts you to rename the deleted file before undeleting it. If you enter the new name in lowercase letters, however, you'll never be able to access the file again. You can't open it, copy it, or even delete it!

It turns out that MWUNDEL writes the filename into the directory entry *exactly* as entered—in lowercase characters. But since all DOS and Windows file functions translate filenames to uppercase letters, no program will ever be able to find that file. It will be just as if the file does not exist.

The DOS version of UNDELETE

does not share this problem. It correctly translates the filename into uppercase letters before writing the filename to the directory entry. One way to regain access to a file with a lowercase name is to use a disk editor like The Norton Utilities to edit the directory entry and change the filename to uppercase.

David C. Chang
San Marino, California

► **PC MAGAZINE:** Try this: You'll be amazed! Run the Windows version of UNDELETE (MWUNDEL), select a directory, and choose a deleted file. Before you undelete it, use Notepad to create a file that has the original name of the deleted file. For example, if the file was called DATA.DAT, MWUNDEL will show it as ?ATA.DAT. Open Notepad, type one character, and save the resulting file as DATA.DAT.

Close Notepad, return to MWUNDEL, and undelete ?ATA.DAT. MWUNDEL will prompt you for the first character, noting that d is not valid. Enter d anyway, and when the Undelete Alert dialog appears, press Enter. You'll be prompted to enter a new name—enter it in lowercase. That's it! You've created a problem file whose name is un-

acceptable to DOS and Windows commands.

You can get rid of this problem without resorting to a disk-level editor. Start by using DOS 6.0's MOVE command to move all files in the directory to a temporary directory. The offending file will be left behind, because MOVE can't deal with a lowercase name. Now type either DEL *.* to delete the file or REN *.* NEWNAME.EXT to give it a new name. Finally, MOVE the other files back and then delete the temporary directory.

Parsing a String with a Batch File

Use a compiler that requires the full pathname of the program for the compile step but just the program name for the link step. I wrote a batch file called NAMEPART.BAT (shown in Figure 1) that takes a full pathname as its command line parameter and places the filename portion in the environment variable *justname*.

NAMEPART.BAT first puts the pathname into the environment variable *y*. The call to SETCH_RM.BAT (Figure

NAMEPART.BAT

Complete Listing

```
:: NAMEPART.BAT
:: pick off JUST the name part of a
:: full path spec - d:\path\name
@ECHO OFF
SET y=%1

:top
CALL SETCH_RM %y%
IF "%Ch%"=="\" %0 %Rm%
IF "%Ch%"==" " GOTO end
SET y=%Rm%
GOTO top

:end
SET justname=%1
ECHO Name part is "%justname%"
```

Figure 1: NAMEPART.BAT extracts the filename part of a full pathname by using the batch file SETCH_RM.BAT (Figure 2).

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2) puts the first character of *y* into the e-var *Ch* and the remainder into the e-var *Rm*. If that first character is a backslash, the following line reexecutes NAMEPART, passing just the remainder to it.

If *Ch* is null, the batch file has processed the entire filename, and its current first parameter doesn't contain any backslashes. In that case, it jumps to the label *end*, where it sets the e-var *justname* to the filename. The batch file that calls my compiler can now easily use the full pathname for the compile step and strip it down to the program name for the link step.

There are many other uses for SETCH_RM.BAT. FILENAME.BAT (Figure 3) picks off the filename portion of a FILENAME.EXT combination. It repeatedly strips the first letter from the name passed as the first parameter and

SETCH_RM.BAT

Complete Listing

```
:: SETCH_RM.BAT
:: set Ch to first char of command
:: line param, Rm to remainder
IF %2==% GOTO Init
IF NOT %Ch%==% SET Rm=%2
IF %Ch%==% SET Ch=%2
GOTO End
:Init
SET Ch=
SET Rm=
FOR %v IN (%1) DO CALL %0 %1 %v
:End
```

Figure 2: Pass a string to SETCH_RM.BAT, and it will store the first character in the environment variable *Ch* and the remainder in *Rm*.

FILENAME.BAT

Complete Listing

```
:: FILENAME.BAT
:: pick off JUST the filename part of
:: a filename.ext
@ECHO OFF
SET y=%1
SET filename=

:top
CALL SETCH_RM %y%
IF "%Ch%"=="." GOTO end
IF "%Ch%"=="\" GOTO end
SET filename=%filename%Ch%
SET y=%Rm%
GOTO top

:end
FOR %v IN (y Ch Rm) DO SET %v=
ECHO Filename portion is "%filename%"
```

Figure 3: Here's another use for SETCH_RM.BAT: This batch file extracts just the name portion of a filename and its extension.

appends the letter to the end of the environment variable *filename*. If the character is a period or the end of the string is reached, the batch file jumps to the label *end*, where it clears all the environment variables used except *filename*.

Here's another use: Users often want to back up their files using a filename with the current date. PACKDATE.BAT (Figure 4) puts the current date into the e-var *date* and removes the dashes from it. PACKDATE uses the familiar CURRENT.BAT technique, where CURRENT.BAT contains the single line SET date=%4. PACKDATE copies the value of *date* to the e-var *d* and clears *date*. Then it picks off *d*'s characters one at a time, appending each character to *date* if that character is not a dash.

SETCH_RM.BAT has proven to be a very useful routine in the batch files that I run regularly.

Bill McDaniel
Edmond, Oklahoma

►PC MAGAZINE: By now most batch file enthusiasts know about the FOR command's strange treatment of the slash character, but a review never hurts. When an item in the FOR command's list begins with a slash, FOR treats it as two items, the first character and the remainder. Try it at the DOS command line. Enter FOR %v IN (/test) DO ECHO %v, and FOR will echo "t" and "est" separately.

The SETCH_RM.BAT batch file uses this fact to set the environment variables *Ch* and *Rm* to the first character and the remainder (respectively) of any string you pass to it. I modified Mr. McDaniel's original batch file to initialize the two variables automatically. Now the calling batch file needs only to CALL SETRM_CH, passing it the string to be split.

Recently a member of ZiffNet asked how to get the current date into a form that will automatically sort as a string. Specifically, he wanted the date in the form *yyyymmdd*. SORTDATE.BAT, shown in Figure 5, modifies the PACKDATE example to yield the current date in precisely this form. Like PACKDATE, it picks the characters from the date one at a time and appends them to the e-var

PACKDATE.BAT

Complete Listing

```
:: PACKDATE.BAT
:: return the current date in packed
:: form (no dashes)
@ECHO OFF
ECHO/ DATE > READDATE.BAT
CALL READDATE.BAT
DEL READDATE.BAT
SET d=%date%
SET date=

:top
CALL SETCH_RM %d%
SET d=%Rm%
IF "%Ch%"=="-" GOTO top
SET date=%date%Ch%
IF NOT "%Ch%"==" " GOTO top

ECHO Packed date is %date%
```

Figure 4: Call this batch file to get the current date in "packed" form (that is, without the dashes).

SORTDATE.BAT

Complete Listing

```
:: SORTDATE.BAT
:: return the current date in
:: sortable form
@ECHO OFF
ECHO/ DATE > READDATE.BAT
CALL READDATE.BAT
DEL READDATE.BAT
SET d=%date%
SET date=
SET dash=

:top
CALL SETCH_RM %d%
SET d=%Rm%
IF NOT "%Ch%"=="-" GOTO getchar
IF %dash%==% GOTO finish
SET dash=1
GOTO top

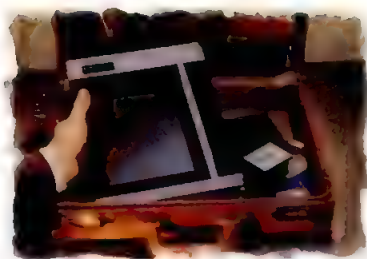
:getchar
SET date=%date%Ch%
IF NOT "%Ch%"==" " GOTO top

:finish
SET date=%Rm%date%
FOR %v IN (d Ch Rm dash) DO SET %v=
ECHO Sortable date is %date%
```

Figure 5: This batch file returns the current date in sortable *yyyymmdd* format, suitable for use as a filename.

date, omitting dashes. But when it reaches the second dash, it simply prefixes the remainder of the original date (the year) to the built-up string in the e-var *date*. The result is the current date in *yyyymmdd* format.

You can download all the batch files mentioned in this column from PC MagNet's Utilities/Tips Forum. Look for the file NAME.ZIP. □



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Tutor

BY JEFF PROSISE

Keeping Your Hard Disk Healthy with ScanDisk

For as long as hard disks have been around, hard disk maintenance tools have also been around. Products such as Symantec's The Norton Utilities and Gibson Research's SpinRite have been staples among PC users and are always ready to sort out the mess when a hard disk goes south or a disk's file structures become scrambled beyond recognition. Traditionally, DOS has lacked such tools, offering only the CHKDSK command. CHKDSK will do in a pinch, but it has several limitations. CHKDSK detects only certain types of disk errors (primarily those involving information DOS writes to a disk to record the locations of files and subdirectories), and it won't fix all the errors it does find (CHKDSK will report cross-linked files, for example, but won't do anything about them). CHKDSK also and relies on a primitive command-driven interface for interaction with the user. Furthermore, CHKDSK offers precious little help when a compressed volume file (CVF) used by a DoubleSpace drive becomes corrupted.

It took a while, but in MS-DOS 6.2, CHKDSK has finally gone the way of the dinosaur. Its replacement: the ScanDisk utility, which marries the capabilities of CHKDSK with an interactive user interface and more extensive disk-repair features. ScanDisk does everything CHKDSK did and then some. In fact, when you run DOS 6.2's CHKDSK command, you receive the following admonition: "Instead of using CHKDSK, try using SCANDISK. SCANDISK can reliably

detect and fix a much wider range of disk problems. For more information, type HELP SCANDISK from the command prompt." Clearly, Microsoft intends for DOS users to throw away CHKDSK and use ScanDisk instead, even though CHKDSK was not removed from the DOS command set.

Used regularly, ScanDisk can find and repair most kinds of disk errors and prevent a few errors from propagating into many. It even performs surface scans to check a disk's physical integrity and recovers data from damaged CVFs. Unfortunately, the DOS 6.2 package doesn't contain a whole lot of information about ScanDisk, because the manual provided with 6.2 is the same one that was provided with 6.0. The on-line help system (HELP SCANDISK) provides some information but not nearly enough to satisfy power users. Here, then, is the vital information about ScanDisk that you won't get from the manuals, including operational details concerning what it does and how it works. We've also included a table of ScanDisk's parameters (see Figure 1).

CHECKING LOGICAL INTEGRITY To begin scanning a disk with ScanDisk, at the command prompt, type SCANDISK followed by a drive letter. (If you omit the drive letter, ScanDisk will default to the

current drive. If you omit the drive letter and include a /ALL switch, ScanDisk will scan all your drives.) ScanDisk will scan most types of disks, including hard disks, floppy disks, and RAM disks, but it will not work on CD-ROM drives, network drives, or "phantom" drives—drives created by the SUBST or INTERLNK commands. ScanDisk will let you know if you run it on an unsupported drive type, and it will mistakenly identify a CD-ROM drive as a network drive, because internally DOS treats the two roughly the same.

ScanDisk begins by scanning a disk's logical structure: the file allocation table (FAT), the root directory, and the directory entries stored outside the root directory (entries corresponding to files and subdirectories that are themselves stored in subdirectories). ScanDisk also checks the disk's *media descriptor byte*, a byte at the beginning of the FAT that identifies the disk type. A value of F8h, for example, identifies a hard disk, while F0h identifies a 1.2MB, a 1.44MB, or a 2.88MB floppy disk.

The two most common errors that ScanDisk reports are *lost clusters* and *cross-linked files*. A cluster is a group of one or more sectors and represents the smallest amount of space that DOS will allocate on a disk for file storage. For each cluster on the disk, there is one entry in the FAT. The value stored in a cluster's FAT entry tells DOS whether the cluster is used or free and if it's used, the number of the next cluster in the file's allocation chain. Lost clusters result

when one or more clusters are marked in the FAT as if they belong to a file but do not appear in the chain of FAT entries for any valid file. Lost clusters needlessly tie up disk space. They won't be allocated to another file, because they're marked as if they are in use but in fact are not. Cross-linked files are files whose FAT chains converge on a common cluster. That's bad news, because if you delete one of the files, part or maybe all of the other file will be deleted also. If

The ScanDisk utility marries the capabilities of CHKDSK with an interactive user interface and more extensive disk-repair features.

you write data to either file, you risk corrupting both of them.

If ScanDisk finds errors during the logical scan, it displays a screen like the one shown in Figure 2. In this example, ScanDisk reports finding "1,351,680 bytes of data on drive C: that might be one or more lost files or directories, but which is probably just taking up space." This sounds suspiciously like lost clusters. Clicking the More Info button (or pressing M) to display the More Information screen (Figure 2) confirms this, revealing that drive C: contains 660 lost clusters in 120 chains. If you choose Save, ScanDisk rescues the lost clusters the same way CHKDSK did when you answered yes to the question, "Convert lost chains to files?"—that is, by converting them to files named FILEnnnn.CHK in the disk's root directory. If you call up a .CHK file in a text editor or a word processor and recognize it as text once belonging to a document file, you can rescue it by copying it out. If you don't recognize the contents of a .CHK file (usually you won't if the data isn't text-based), delete it to free up disk space. ScanDisk's Delete option removes lost clusters outright. Using this option is equivalent to using CHKDSK with the /F parameter and then answering no to the "Convert lost chains to files?" message.

In all, ScanDisk detects and repairs dozens of different types of errors. These checks and repairs fall into four categories, which are checked off on the screen as they are completed:

Media descriptor. ScanDisk verifies that the disk's media descriptor byte is valid. If it is not, ScanDisk offers to repair it by writing the appropriate value to

the disk. ScanDisk will also (and this feature is undocumented) repair the 2 or 3 bytes that follow the media descriptor byte, which are always set to FFh.

Directory structure. ScanDisk traces through the disk's directory structure to ensure that all directory entries are valid. If ScanDisk finds a subdirectory that is no longer accessible because the chain of FAT entries leading to that subdirectory has been corrupted, ScanDisk attaches the subdirectory to the root directory using a name of the form DIRnnnnn.

If a directory entry contains minor errors (for example, if the dot or double-dot entries point to the wrong location, or a subdirectory entry's file-size field holds an incorrect value), ScanDisk fixes them on the spot. If the entry is damaged more extensively, ScanDisk deletes that entry from the disk and recovers the disk space.

File structure. This is where ScanDisk checks for lost clusters, cross-linked files, and other errors related to invalid allocation chains. Other errors uncovered in this phase include invalid FAT entries (free FAT entries appearing in the middle of a file's allocation chain) and invalid size information (for example, when the number of clusters that should be allocated to a file, which can be computed from the file-size field of the file's directory entry, does not agree with the count of clusters reserved for the file in the FAT). Unlike CHKDSK, ScanDisk can correct cross links for you. How does it do this? By

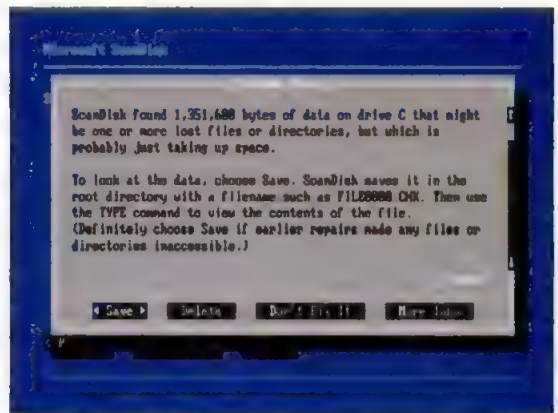


Figure 2: When ScanDisk identifies disk errors, it describes what it found and in most cases offers to fix the errors for you.

making part of a good file by modifying or deleting the bad one.

File allocation tables. Most disks contain two copies of the FAT in case one goes bad. If DOS can't read the primary FAT because a read error occurs, it automatically looks to the other copy. In this step, ScanDisk compares the two copies and updates the secondary FAT to match the primary if the two are not identical.

Before it performs any repairs, ScanDisk offers to write undo information to a floppy disk. If after allowing ScanDisk to make repairs, you find that a file or directory you need is no longer there, you can restore the disk to its former (damaged) state with the undo disk.

When run on a drive compressed with DoubleSpace, ScanDisk goes even further. In addition to checking everything listed above, it also checks these important areas of the compressed drive's CVF:

DoubleSpace file header. The compressed volume file corresponding to every DoubleSpace volume contains a data structure called MDBPB, which contains all the information in the disk's normal BPB (BIOS parameter block) plus some additional information specific to DoubleSpace—information such as the compressed drive's size and pointers to other DoubleSpace data structures. When ScanDisk refers to the DoubleSpace file header, it's really referring to the MDBPB. In many cases, ScanDisk can repair errors in the MDBPB by reconstructing information in it from information stored elsewhere in the CVF and thereby

ScanDisk Command Line Switches

Switch	Meaning
/ALL	Check all local drives
/AUTOFIX	Fix errors without prompting
/CHECKONLY	Check for but do not repair errors
/CUSTOM	Run ScanDisk using the configuration settings in SCANDISK.INI, which is located in the same directory as SCANDISK.EXE
/MONO	Run ScanDisk in monochrome mode
/NOSAVE	Delete lost clusters (as opposed to saving them to files in the root directory); only valid in conjunction with /AUTOFIX
/NOSUMMARY	Do not display summary screens and do not prompt for an undo disk
/SURFACE	Perform surface scans without prompting

Figure 1: Use these parameters with the SCANDISK command to customize its operation to your liking.

making a second copy of the file data that is common to both files and rewriting the FAT chain for one of the files to reference the newly allocated clusters. One of the files will contain bogus data, but the disk error is fixed, and you no longer risk los-

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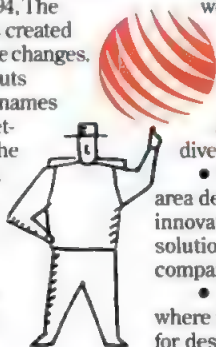
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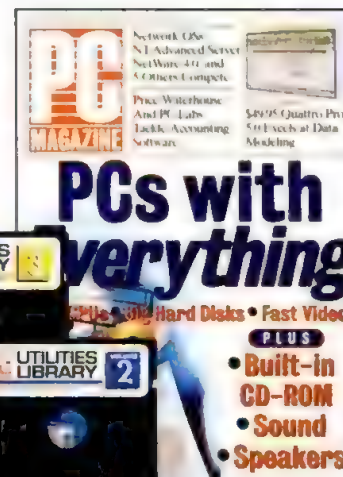
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restore a malfunctioning compressed drive to working order. This is important, because damaged MDBPBs frequently prevent a compressed drive from being mounted. (A compressed drive must be *mounted* before it appears to the system as a compressed drive. In effect, mounting virtualizes a CVF, elevating the CVF to the status of a logical drive.) When a compressed drive can't be mounted, the data stored on it can't be accessed.

DoubleSpace file allocation table. On compressed drives, DoubleSpace uses a data structure called the MDFAT to correlate clusters on the compressed drive to sectors in the CVF's sector heap. (For more information on the MDFAT, the sector heap, and the CVF, refer to the November 23, 1993, Tutor column, "DOS 6.0's DoubleSpace: Is It Safe?") During this phase of operation, ScanDisk scans the MDFAT for errors. Among other things, it looks for MDFAT entries containing sector numbers that point beyond the end of the sector heap. Left uncorrected, this type of error produces data errors when the affected file is accessed. ScanDisk will patch the MDFAT to correct such errors, although lost data may result.

Compression structure. Here, ScanDisk checks the MDFAT for cross links—MDFAT entries that reference the same compressed cluster in the sector heap. ScanDisk also cross-references the FAT and MDFAT of the compressed drive, checking for instances in which the MDFAT entry is marked used and the FAT entry is marked unused. By marking the MDFAT entries unused, ScanDisk can free up space on the compressed drive—space that is currently being reserved for no reason.

Volume signatures. CVFs contain two 4-byte signatures (also called *stamps*) at precise locations, which DoubleSpace uses to identify CVFs. If these signatures have been corrupted, ScanDisk will rewrite them for you.

Boot sector. The first sector of every DOS formatted disk, which is known as the *boot sector*, contains information about the disk's physical characteristics as

well as other data. Every CVF contains a boot sector, which becomes the compressed disk's boot sector once the drive is mounted. If the CVF's boot sector does not agree with the boot sector on the drive

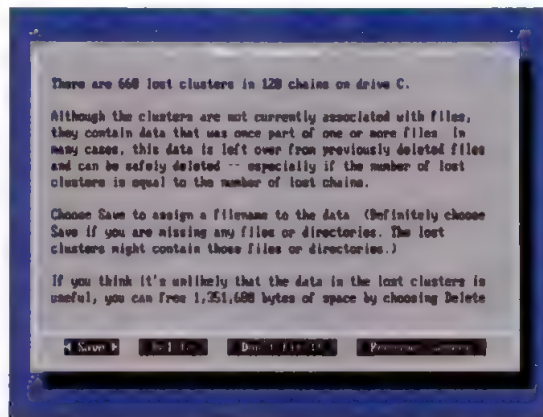


Figure 3: Supplementary screens display further details about disk errors and offer helpful advice on fixing them. The information contained in these screens is directed toward more advanced users.

you booted from, ScanDisk offers to repair this condition for you. This type of error usually isn't critical, but a damaged copy of the boot sector can cause some disk utilities to behave improperly.

ScanDisk is a vital tool to have on hand when things go wrong with DoubleSpace. When DoubleSpace mounts a compressed drive, it performs the equivalent of a CHKDSK on the CVF. If errors are found, DoubleSpace informs you that the CVF is damaged and refuses to let you access anything on the compressed drive. If this happens, run ScanDisk on the damaged CVF immediately. The command

```
SCANDISK C:\DBLSPACE.000
```

checks the primary CVF on drive C:. If you want repairs to be performed automatically (as opposed to being prompted), include a /AUTOFIX switch, as in

```
SCANDISK C:\DBLSPACE.000 /AUTOFIX
```

By default, ScanDisk saves lost clusters to files when started with /AUTOFIX. If you'd prefer that lost clusters be deleted, add a /NOSAVE switch as well. You should also run ScanDisk on a CVF if DOS reports data errors when accessing certain files. The errors could be due to a

physical defect in the host drive, or they could be symptoms of invalid entries in the MDFAT, either of which ScanDisk can correct.

CHECKING PHYSICAL INTEGRITY After finishing the check on the disk's logical structure, ScanDisk offers to perform a surface scan on the drive to check its physical structure. (You can suppress the prompt and have ScanDisk perform the surface scan automatically by starting it with a /SURFACE switch.) The screen shown in Figure 3 apprises you of a surface scan's progress. During the scanning operation, ScanDisk reads and writes every sector on the disk, checking for data errors. If it finds one or more sectors that can't be read, it warns you of the error and offers to correct the problem. ScanDisk can't really restore bad sectors to health again; bad sectors are caused by physical defects or damaged spots in the disk's magnetic coating. What ScanDisk does instead is mark the clusters containing the bad sectors so they won't be used anymore (certain FAT entry values are reserved for marking bad clusters) and copy as much data as possible from the bad clusters to good clusters. Then it patches the FAT so that the good clusters replace the bad in the allocation chain.

How does ScanDisk's surface scan compare with surface scans performed by industry-leading disk-repair programs such as SpinRite? Not very favorably. ScanDisk's primary reason for being is to detect troublesome disk errors before DoubleSpace is called on to compress the drive. (One of the reasons that DOS 6.0's DoubleSpace failed on some PCs was that critical CVF data structures were being written to defective areas of the hard disk. In DOS 6.2, ScanDisk is called to map out bad sectors before the CVF is created.) For that, it serves its purpose. SpinRite, on the other hand, was designed to do much more. Here are some of the key differences between SpinRite and ScanDisk:

- SpinRite determines what encoding method a controller uses to store information on a hard disk (no mean feat in itself) and writes to the disk patented bit patterns designed to bring out the worst in the detected encoding method. As a result, SpinRite is frequently able to detect developing defects before they become

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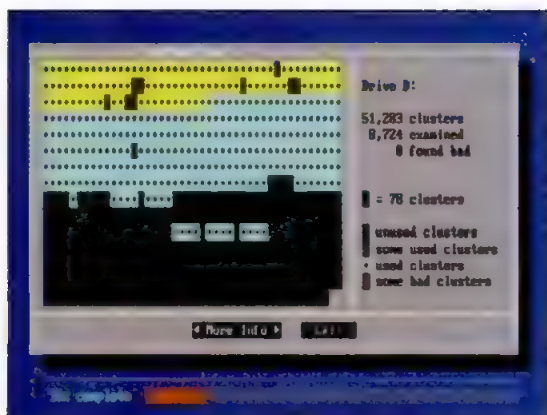


Figure 4: During a surface scan, ScanDisk keeps you apprised of its status. Areas marked in yellow have already been checked.

full-fledged defects and head off data loss. ScanDisk, by contrast, simply reads each sector and writes back what it read. Therefore, most of the sectors on the disk don't get stressed to the maximum extent possible.

- When ScanDisk reads and writes individual sectors, it does so using interrupt 13h services in the BIOS. Interrupt 13h

returns—including information concerning ECC fix ups. Once again, this enables SpinRite to find many trouble spots before they fully develop.

- When it does encounter a bad sector, SpinRite can often recover most or all of the data by employing a variety of creative techniques, which range from reading the affected sector several times and

routines are convenient, but they mask much of the work the controller is doing. For example, if the controller uses ECC (error correction code) data to fix up a faulty read, the vast majority of BIOSes happily pass the data to the caller as if nothing had happened. Therefore, ScanDisk may think that all is well, when in fact the sector is slowly going bad. SpinRite works around this problem by bypassing the BIOS and programming the controller directly, where the utility enjoys access to all the information that the controller

using statistical analysis in order to extract the valid bits to “wiggling” the drive heads. The latter consists of approaching the bad sector from different distances and directions to produce small displacements in the head's final position over the track—a technique that SpinRite also puts to use when reading data in floppy disk drives with misaligned heads. ScanDisk usually isn't very effective in lifting data from a defective disk, because it gets back only the information that the BIOS gives it. Often that isn't much.

ScanDisk is a welcome and much-needed replacement for CHKDSK, but don't be misled into believing that it obviates the need for utilities such as SpinRite. As is often the case, the third parties still do it better. The significance of the surface-scan component of ScanDisk is that prior to MS-DOS 6.2, most users employed no low-level disk-maintenance software at all. ScanDisk serves both to raise awareness about surface problems and to provide users with a simple tool for rooting them out. □

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Toolkits

BY NEIL J. RUBENKING

WINGate Soups Up DOS Boxes

WINGate, Version 1.38, from WINGate Technologies, brings new power and flexibility to developers porting legacy DOS applications to Windows. No longer must you rewrite all your code to take advantage of interprocess communication and other special Windows services; with WINGate, you can do it from a DOS box.

WINGate accomplishes this magic through client/server-style interprocess communication managed via a virtual device driver (VxD). When the WINGate VxD is installed, any DOS or Windows program you write can function as a client, a server, or both. This lets you port a DOS legacy program to Windows simply by giving the program WINGate server capabilities, thereby creating a Windows interface program that's a WINGate client.

The \$295 WINGate product contains everything necessary to write clients and servers using C or C++ and includes several demonstration servers—single-purpose applications that provide Windows-style services to DOS programs. Additional libraries (\$49 each) add support for Borland Pascal, FORTRAN, BASIC, Clipper, FoxPro, and more. We examined the Borland Pascal version. Distributing the WINGate runtime VxD costs \$55 per workstation. The demo servers cost \$22 per workstation, though most WINGate users will write their own multipurpose servers. Quantity discounts are available.

The demo servers show off what this technology can accomplish and help you get started faster. The demo servers that come with WINGate are WinSpawn, to execute Windows programs such as Help, File Manager, or Notepad; WinKill, to ter-

minate Windows programs; WinClip, to access the Windows Clipboard; WinDDE, to exchange information with a DDE server; WinCtrl, to control the appearance of windows on the desktop; WinMem, to manage shared-memory areas; and WinKey, to send keystrokes to Windows programs. Sample clients that access the demo servers are also included. Unfortunately, source code for the demo servers is not provided, and there is only limited source code for the sample clients.

WINGATE ESSENTIALS A WINGate client starts by initializing and registering itself with WINGate and checking to ensure that all needed servers are available. When the client finishes, it must unregister itself and terminate its connection with WINGate.

While the client is active, it communicates using *transactions*, a data structure containing communication data for both WINGate and the server. The client builds a transaction, calls WINGate to pass it to the server, and then waits for the server to respond with another transaction or for the specified time-out to expire.

WINGate isn't for novice programmers. Its slim manual provides the necessary information about WINGate's API functions and transaction structures but little more. The few example programs are difficult to follow, so you'll need to spend time getting familiar with the product.

Many of the WINGate functions come in pairs: Use one without the other and your program can crash badly. It's best to insert both items of a pair at once. For example, start by adding the calls to initialize and terminate WINGate operations,

and between them insert the calls to register and unregister the application as a WINGate client. Insert the calls to create and destroy each transaction as a pair. Following this technique, we had no trouble creating applications, such as a DOS setup demo that establishes a new Program Manager group and populates it with program icons, all via DDE.

NEW POWER FOR DOS APPS Windows programs must actively cooperate in multitasking, but multitasking of DOS boxes is handled preemptively without any effort from the application. This usually doesn't give any particular advantage, however, because DOS boxes are isolated from each other and from the rest of Windows. WINGate can let you exploit this feature. If a Windows program contains a function that takes a long time to complete, the programmer must ensure that Windows can get control and process messages. Put that same function in a DOS-based WINGate client, and you can turn control of the multitasking over to Windows.

WINGate can also make it much easier to port very large DOS programs. Because WINGate lets DOS programs intercommunicate, large DOS programs can be broken up into several separate programs that execute simultaneously and share data.

Another way WINGate can help with large DOS programs is by providing them with more memory. With WINGate, DOS programs running under Windows can allocate as much memory as Windows will allow; they are not limited to 640K. This can save programmers a lot of rewriting. If porting legacy

code from DOS to Windows is your particular headache, WINGate can greatly reduce the amount of work you must do.

• WINGate, Version 1.38

List Price: With C/C++ libraries, \$295; additional language libraries, \$49 each; runtime version, \$55 per workstation; runtime demo servers, \$22 per workstation; volume discount and site license available. Requires: Microsoft Windows 3.1 in 386 Enhanced mode, supported language compiler. WINGate Technologies, High Street Ct., #303, Morristown, NJ 07960; 800-946-4283, 201-539-2727; fax, 201-539-2838.

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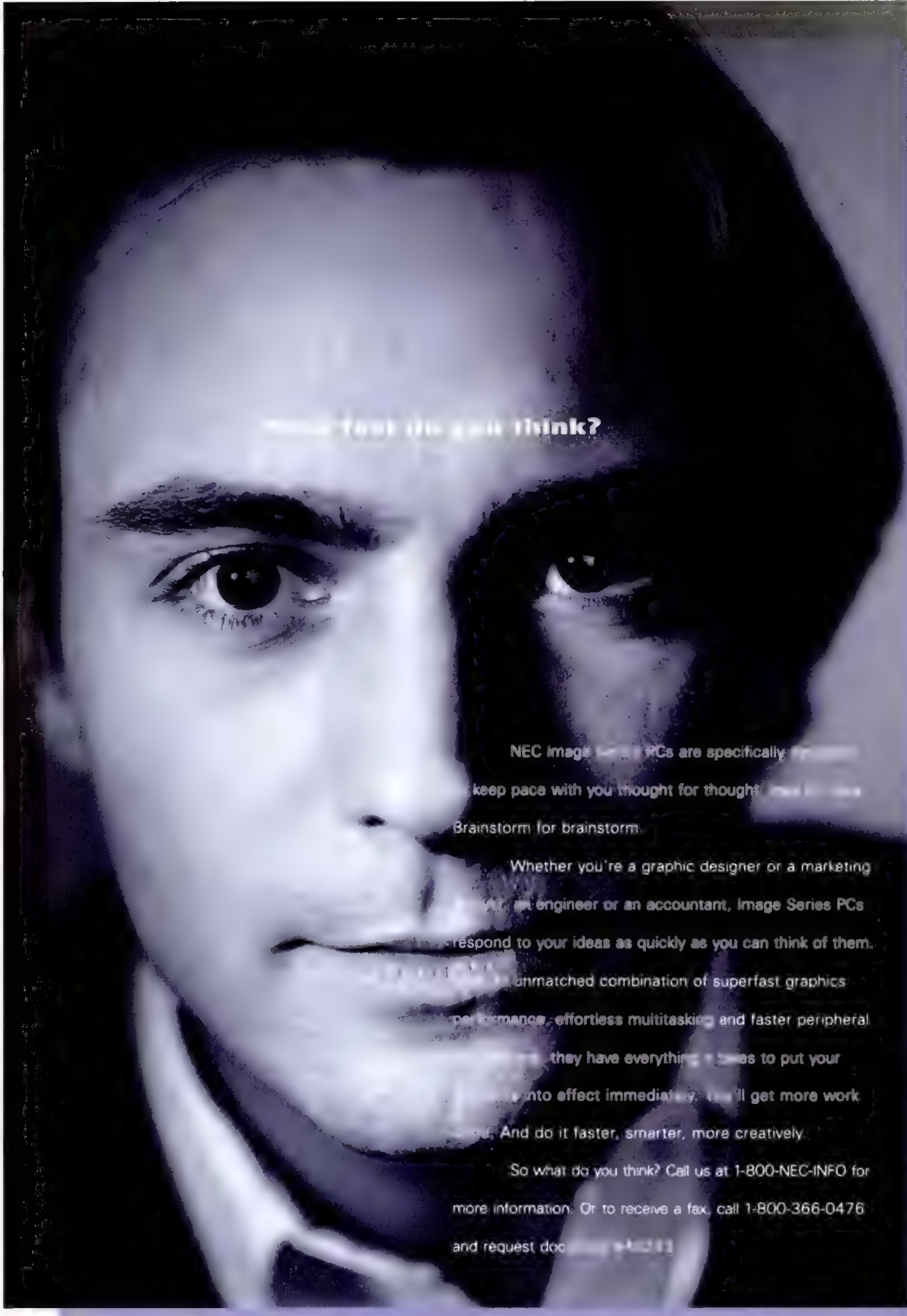
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Power Programming

BY RICHARD HALE SHAW

An Introduction to The Win32 API

If you haven't heard much about Win32 yet, it's because you've been under a rock. Win32 is a programming specification for the 32-bit version of Windows and likely to be the specification for the next generation of personal computers. With sophisticated 32-bit memory management, a flat memory model, multithreaded and symmetrical multiprocessing support, application-level exception handling, and multiple security mechanisms built-in, Win32 is designed to make applications more portable, extensible, flexible, and robust than ever before. In short, Win32 is designed to support a new generation of applications that will carry personal computing well into the next century.

Traditional operating-system designs often seem to be the result of a Hatfield and McCoy-style feud where systems and application developers can't agree on who will provide what services. For example, Windows 3.1 developers often have to tailor an application to fit the way Windows works—designating which memory blocks are movable or discardable—so that Windows can run efficiently. With applications written to the Win32 specification, on the other hand, the underlying operating system's virtual-memory manager is responsible for moving or discarding pages of memory without the need for the application or the developer to get involved.

In this column, I'll begin to describe the features and benefits of developing for Win32, and its implications for application and operating-system memory management. I'll show you what Win32 offers, whether you're targeting your applications for Windows NT or for the next release of desktop Windows, code-named Chicago. I'll show you not only why pro-

gramming for Win32 is easier than programming with Win16, but I'll point out benefits of utilizing features found in Win32 that weren't available in Win16. By the time we're through, you'll have a clear idea of what Win32 has in store, and you'll be ready to move on to more specific details in each of these areas. In future Power Programming columns, you'll see even more examples of how Win32 exposes built-in operating-system features such as structured exception handling and memory-mapped files.

WHY WIN32? From the outset, Windows was designed to run on 16-bit processors of the Intel 80x86 family: the 8086, 8088, and 80286. These CPUs address memory via two registers: one register containing the address of a memory segment and the other containing a 16-bit offset into that segment. Thus, all of a system's memory was divided into segments that could be up to 64K each. (64K is the largest address you could access with a 16-bit address.) In addition, these CPUs had limits on the total memory they could access. In the case of the 8088 and 8086, the limit was 1 megabyte; for the 80286, 16 megabytes was the upper limit. Even after Microsoft updated Windows to run on the 80386 and the 80486, the 16-bit Windows could access up to only 64 megabytes of RAM.

Windows 1.0 was originally designed to emulate 16-bit protected mode, and Version 3.1 was designed to run in 16-bit

protected mode. In protected mode, the CPU tracks a segment via a *selector*—an index into a descriptor table that's maintained by the operating system. Each descriptor identifies the associated segment, its permissions, and its size.

Such an operating system can maintain a global descriptor table (GDT) for all global memory blocks and a separate local descriptor table (or LDT) for each application to track memory usage. But because 16-bit Windows maintains a single LDT for all applications, it's possible for one application to access the memory of another and bring that application or even Windows itself to a grinding halt.

If that weren't enough, 16-bit Windows' ability to multitask applications is severely limited. Because it was originally designed to run on hardware that didn't support multitasking, Windows doles out CPU time via its own scheme, offering nonpreemptive multitasking that worked as long as every application cooperated. If an errant application took too long before returning control—or worse yet, never returned control—Windows might crash and burn. Rather than protecting each application from other ones, Windows 3.1 is as vulnerable as any other application to errant behavior in a program.

Win32 is a programming specification for the 32-bit version of Windows and likely to be the specification for the next generation of PCs.

The 16-bit addressing and the 64K segment limitation put severe limits on Windows and the applications that run on it. Every memory object is restricted to 64K or less; an application would have to jump through hoops juggling register values in order to address multiple 64K segments as a contiguous block. In

an attempt to shield application developers from the segmented architecture, some development-tool vendors implemented a variety of pointer types—near, far, and huge—which hid the register arithmetic required to manipulate both intrasegment and intersegment objects. These Band-Aid fixes only added an unnecessary layer of confusion and complexity.

Responsibility for 16-bit Windows'

memory management is split between the operating system and the application developer. Developers of Windows applications often face difficult questions: Do I make this application segment fixed or movable? Should it be discardable, too? Should I allocate this object from the application's local memory or from Windows' global heap? Will it be in memory when my application needs it?

If you mark a segment fixed, for example, Windows can't move the segment around when it needs to defragment memory and free up larger blocks. If you make the segment movable, the application can't maintain a pointer to the segment without constantly refreshing the pointer: After all, the segment might have been moved by Windows. And while discardable segments help Windows free up memory blocks, you have to remember to reinstate the segment at the cost of a performance hit whenever Windows rereads a discarded segment from the disk.

Finally, 16-bit Windows provides a single 64K data segment for storing handles to bitmaps, icons, menus, and other GDI objects. Once this segment is exhausted, Windows would either slow to a crawl or stop operating altogether. If an application doesn't clean up after itself, blocks of global memory or portions of the GDI data segment remain allocated, cluttering up the system and eventually impeding the operation of other applications.

Thus, 16-bit Windows forces the application developer to be a part-time systems programmer, while restricting application size and barely taking advantage of contemporary, 32-bit hardware. It's a real mess.

To survive, Windows had to be updated and changed. The result is a specification known as Win32. Win32 is not an operating system as such, rather it's a specification for extending Windows and the Windows API to take advantage of 32-bit hardware platforms. Thus, Windows NT and Chicago are not Win32 but operating-system products designed to fit that specification. Windows NT fully implements Win32, while Chicago implements a subset of its features. And while Win16 was the primary programming interface for 16-bit Windows, 32-bit operating systems may support more than one API. For example, Chicago supports both Win16 and Win32,

while Windows NT supports both as well as character-mode OS/2 and POSIX APIs.

In both systems, however, Win32 is the primary interface, since it provides services to the others. Win32 virtualizes memory to provide a 32-bit view of memory that's not segmented, along with functions to manipulate that memory. Win32 makes it possible to move virtual memory around in physical memory, letting you use pointers instead of handles to access that memory. Win32 lets you suballocate your applica-

Windows NT Memory Map



Figure 1: For Windows NT, Win32 evenly divides its 4-gigabyte virtual-address space into 2GB for the system and 2GB for the application. The first 64K of the process's address space is reserved to trap NULL pointers.

tion's virtual address space to create application-specific heaps or lets you reserve memory blocks that aren't committed to physical space until later. Win32 even exposes operating-system-level features—such as structured exception handling and memory-mapped files—for use by application developers.

WIN32'S MEMORY ORGANIZATION Unlike Windows and the Win16 API, Win32 is expressly designed for 32-bit processors, such as the Pentium, the PowerPC, and the MIPS CPUs of the nineties: The minimum Intel hardware for Win32 is the 80386. Where Win16 systems could address only 64 megabytes of RAM, Win32 can address up to 4 gigabytes. Where Win16 uses nonpreemptive, cooperative multitasking for Windows applications, Win32 offers full-fledged preemptive multitasking and multithreading. And where Win16 is vulnerable to the well-intended but misguided actions of some applications, Win32 does not countenance errant application behavior.

Win32 always implements a virtual memory system where every address,

rather than representing a physical location in RAM, is part of a 4GB virtual address space regardless of how much physical RAM is installed. Win32 divides memory into pages not segments, and the page size is optimized to fit the architecture of the underlying hardware (on Intel and MIPS CPUs, the page size is 4K; on the DEC Alpha, it's 8K).

A Win32 system's virtual-memory manager determines which pages are located in virtual memory and which are in RAM, and provides a mechanism for translating virtual addresses into a physical ones. The virtual-memory manager can move pages around, swap them to the disk, or discard them altogether (provided they can be reread from the disk) if it needs additional physical memory. When the virtual-memory manager moves or reloads a page of physical memory, it simply remaps that page's virtual addresses to the new physical page addresses. An attempt by an application to access a page that's been swapped out will cause what's known as a system page fault—a trigger that causes the system to reload the desired page back into memory.

The newly loaded page will probably occupy a physical address that's different from the previous one, but the page will always occupy the same virtual address; the virtual-memory manager will simply remap the page to the same virtual address. Then the operating system will return control to the application at the instruction that caused the page fault. The process is completely transparent to the application.

With Win32, memory pages are always in one of three states: *free*, *committed*, or *reserved*. A free page is one that can't be accessed, but it can be committed or reserved at any time. A page is committed if the system has allocated physical space for it in RAM or in the paging file; a committed page can be read-only, read/write, or restricted from access. If a page is reserved, however, the virtual addresses it represents are set aside; they aren't accessible or associated with RAM or disk storage (I'll explain the importance of reserved pages in a moment). Win32 uses these page states to create an application's virtual address space.

Using the virtual-memory techniques described above, Win32 implements a 4GB address space, where each applica-

tion—or *process* in Win32 parlance—thinks that it's the only application running in the system. Win32 always relegates the bottom 2 gigabytes to the process—with the exception of the first few pages of virtual addresses: On Windows NT, the first 64K of each process's address space is reserved so that NULL pointers and other errors can be trapped. Thus, a process will never have code or data residing in the first 64K. Chicago reserves the first 16K for the same reasons.

By using reserved pages, Win32 can set aside these addresses without physically allocating any memory. The same approach is used to load an application and create the process's address space. A Win32 system will load an application into a set of committed pages, create heap and stack space out of reserved pages, and fill the rest of the process's virtual address space with free pages. Since neither free nor reserved pages occupy any physical memory, there's no memory shuffling involved—just some bookkeeping on the part of the virtual-memory manager.

How Win32 utilizes the upper 2 gigabytes depends on the operating system. For instance, on Windows NT the system owns the entire upper 2 gigabytes (Figure 1), while Chicago reserves only the top gigabyte for itself (Figure 2). Chicago reserves an explicit range of virtual addresses for the use of memory-mapped files—a mechanism for mapping the contents of a file into a range of memory addresses. This is the preferred means for sharing data among applications on Win32. When a Chicago application needs to access a memory-mapped file, the operating system will commit pages from this range of addresses, and a process running on Chicago will always access shared, memory-mapped files in this address range. On Windows NT, however, there is no common, shared address space, and files can be mapped into any memory address in a process's virtual address space. On NT, a shared mapped file may be accessed in one range of addresses in one process and in a different range of addresses in another.

Win32 uses the same approach to prevent one process from accessing the address space of another. Win32 doesn't let one process's physical addresses overlap those of another process, nor does Win32 allow a process to share a physical page

(the only exception being the shared address space in Chicago). And Win32 will not allow a process to access a reserved or free page in its own address space. If a process attempts to access a virtual address that's not in one of its committed pages, Win32 will generate an exception and terminate the process, unless the process has an exception handler installed to handle that particular exception. Thus, Win32 ensures that a process's 2GB virtual address space remains inviolate.

A FLAT ADDRESS SPACE With Win32, every memory location is a 32-bit address—unlike the segmented addressing described earlier—so memory appears to be contiguous or flat. Thus, every Win32 memory object has a full, 32-bit address. With Win32, it's not necessary to perform fancy pointer arithmetic or juggle segment registers: A 32-bit processor can operate directly on 32-bit addresses. And because there are no segments to worry about, pointers do not wrap at the end of a 64K block. Win32 memory is a linear space as flat as a Kansas cornfield.

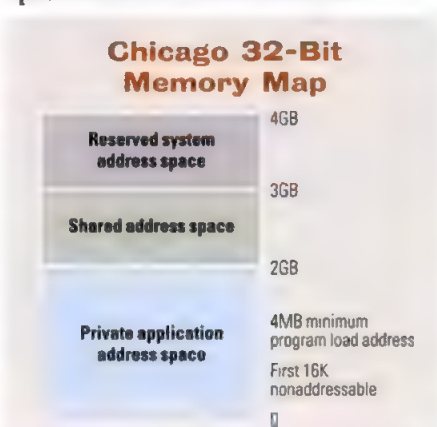


Figure 2: For Chicago, Win32 provides each process with 2 gigabytes, with the first 16K reserved for trapping NULL pointers. Of the remaining 2GB, 1GB is for the system and 1GB is for mapped files, which are used for sharing memory among Chicago applications.

If you ever programmed .COM files (what we now call the Tiny memory model) in the early days of DOS, this should sound familiar. With .COM files, code, data, stack, and heap were all stored in a single 64K segment, and you could even write applications that modified their own code. All of the CPU segment registers contained the same value, so you

could access data embedded in code as easily as casting a pointer to it.

Win32's flat address space is quite similar, with the exception that it's not limited to a puny 64K address space. You can't modify addresses that contain code (they're in read-only, committed pages), but if you want to, you can copy code to the heap and jump to the code's new address to begin execution there.

With segments out of the way, there's no distinction between local and global memory as there was under Win16: All of the memory objects that belong to a process are allocated from that process's private address space. Consequently, the various local and global Win16 memory APIs—like GlobalAlloc and LocalAlloc, or GlobalLock and LocalLock—operate identically and with the same type of memory on Win32. While Win32 retains the Global/Local names for compatibility, you can use them interchangeably if you wish, allocating a block with GlobalAlloc and later freeing it with LocalFree and vice versa. With developers increasingly maintaining code bases in both Win16 and Win32, however, it's probably not a good idea to do this, because of the possible confusion with API names.

Win32 allocates all of the memory objects that belong to a process from the process's private address space, including code, data, heap, stacks, file handles, windows, menus, and GDI resources, such as bitmaps and icons. There is no 64K GDI data segment as in Windows: Every application's GDI resources are allocated from its own address space. If a process needs a DLL, the DLL will be loaded into the process's address space; if the process creates one bitmap or even a dozen bitmaps, they'll all be allocated from that space.

Best of all, when a process terminates, Win32 will delete the process's entire virtual address space from the system. A process may leave orphan GDI objects, memory blocks, and other resources lying around while it's running, and these may slow it down. But a Win32 application cannot terminate and leave resources behind. If the process was sharing an object with another process such that the object is mapped into the virtual address space of both processes, the object won't be deleted immediately. Instead, a reference

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The Win32 Memory Management API Functions

GetProcessHeap	IsBadReadPtr
GlobalAlloc	IsBadStringPtr
GlobalDiscard	IsBadWritePtr
GlobalFlags	
GlobalFree	LocalAlloc
GlobalHandle	LocalDiscard
GlobalLock	LocalFlags
GlobalMemoryStatus	LocalFree
GlobalReAlloc	LocalHandle
GlobalSize	LocalLock
GlobalUnlock	LocalReAlloc
	LocalSize
HeapAlloc	LocalUnlock
HeapCreate	
HeapDestroy	VirtualAlloc
HeapFree	VirtualFree
HeapReAlloc	VirtualLock
HeapSize	VirtualProtect
	VirtualProtectEx
IsBadCodePtr	VirtualQuery
IsBadHugeReadPtr	VirtualQueryEx
IsBadHugeWritePtr	VirtualUnlock

Figure 3: These Win32 memory management API functions will look familiar to Win16 programmers. Some of these API functions look like their Win16 cousins but might work slightly differently.

count, which tracks how many processes are using the object, will decrement. Only when an object's reference count decrements to 0 (and thus no process is using the object) will Win32 delete the object.

MANAGING WIN32 MEMORY If you're already familiar with Win16's memory management API functions, you'll find that Win32 retains a lot of old friends and introduces some new ones (Figure 3). And like old friends in the real world, old API functions—including functions inherited from Win16—change over time.

For example, Win32's GlobalAlloc and LocalAlloc let you allocate a memory block of any size represented by 32 bits, subject to the availability of physical memory and the disk space free to the system paging file. These functions allocate read/write memory in committed pages that are private to the calling process.

For compatibility with Win16, all the old flags—GMEM_DDESHARE, GMEM_MOVEABLE, LMEM_ZEROINIT, and so on—are allowed on Win32,

but not all are supported, and some have different implications. For example, GMEM_DDESHARE is still allowed, but it does nothing: You'll need to create a shared mapped file if you want to share memory with another process. While you can use GMEM_MOVEABLE or GMEM_FIXED, they're not really necessary, since the virtual-memory manager can move a page of memory without affecting the page's virtual addresses. There is still a use for GMEM_MOVEABLE, however, when used in conjunction with GMEM_DISCARDABLE.

When used together, these flags tell the system that the pages containing this block can be discarded altogether if the system needs additional physical storage. You might, for instance, use these flags to designate pages that contain an image or a bitmap that your program could redraw and reconstruct, even though it would be more convenient and efficient to keep available in memory. But you should use this combination of flags only for those data blocks you don't need very often or can recreate easily.

Note that with Win32, you can safely use the standard C library memory functions, such as malloc and free, as well as the C++ memory operators, new and delete. Developers were discouraged from using these functions and operators on Win16, because they allocated fixed rather than movable memory. On Win32, you needn't worry about using these functions and operators unless you want to allocate discardable memory.

If you use GlobalAlloc or LocalAlloc to allocate movable memory, the return value is a handle to the memory block, and you'll still need to use LocalLock or GlobalLock to lock the memory block and return a pointer to it. If you are allocating fixed memory with these functions, however, the return value is a 32-bit pointer, which you can use immediately to access the newly allocated block. For example,

```
HGLOBAL hGlobal = GlobalAlloc
(GMEM_ZEROINIT | GMEM_MOVEABLE, 1024);
LPTSTR lpStr = GlobalLock(hGlobal);
GlobalUnlock(lpStr);
GlobalFree(hGlobal);
```

allocates a block of movable memory. Because the memory is movable, LocalAlloc

returns a handle that has to be locked via GlobalLock before it can be accessed with a pointer. On the other hand,

```
LPTSTR lpStr = GlobalAlloc
(GMEM_ZEROINIT, 1024);
GlobalFree(lpStr);
```

allocates a fixed block of memory and later frees it. Because the memory is fixed, you don't have to unlock a handle first: Instead, the allocation functions return a pointer to the memory. Note that the memory block allocated by GlobalAlloc or LocalAlloc can be larger than the size you request, and your application can use the entire amount. To find out how big a block is, use the GlobalSize or LocalSize functions.

Most other Win32 memory-management functions are quite similar to their Win16 counterparts. For instance, you can still use GlobalReAlloc or LocalReAlloc to change the size or attributes (flag settings) of a memory block or use GlobalFree or LocalFree to release a block. GlobalFlags or LocalFlags still returns a block's attributes, and GlobalHandle or LocalHandle returns the memory handle for the block associated with a specified pointer.

Some Win16 memory management functions, however, haven't been ported to Win32. Some are too processor-specific; others wouldn't be allowed because they allow a direct access to hardware or memory pages, which Win32 doesn't allow. These functions (Figure 4) should be commented out or removed from code being ported to Win32.

VIRTUAL MEMORY API FUNCTIONS

Virtual memory API functions are another operating-system-level feature that Win32 exposes for use by applications. These functions let you go beyond the capabilities provided by GlobalAlloc and LocalAlloc, which allocate only committed, read-only pages of memory, and gain a more granular control over memory management. These functions let you create more flexible solutions to some of the problems that are common in large-scale application development.

For instance, suppose you were building a database buffering mechanism that always needed to have access to a set of 100 database records during the lifetime of your program. These records would be loaded from different parts of a database, and at any

given time you might need only a couple of records, or you might need all 100 records on hand. Using traditional memory management API functions, you'd have to allocate space for each record as it was read and use a linked list (or some other mechanism) to keep track of each record. For efficiency, of course, it'd be a lot easier if you could simply allocate an array of 100 records and just stuff the database records into the array. But if you do this, you'll be unnecessarily maintaining space for any records that aren't currently needed on hand. So you either settle for the inefficiency of a linked list of records or use up a lot of memory by maintaining an array.

Not so with the virtual-memory functions. With these, you can use the same tricks that Win32 uses to manage memory. In this example, you could use the virtual-memory functions to reserve but not commit a range of addresses big enough to encompass the entire array of records. When it's time to read a record into memory, you can simply commit the appropriate address space, or you can decommit those addresses when it's time to throw a record away. You could even combine the use of virtual memory with structured exception handling and write your program to act as if the records were already in memory. Then if an memory exception occurs, your exception handler can commit the previously reserved space and tell the program to resume as if the exception never occurred!

Using the Win32 virtual-memory functions, you can also specify whether a committed page is read/write or read-only, lock an address range to keep its pages from being swapped out of memory, or perform any of the ordinary memory management activities (reserving, freeing, committing, or decommitting a range of addresses).

The primary virtual memory function is `VirtualAlloc`. Use this function to reserve or commit a range of virtual addresses of up to 64K at a time and specify whether they're to be read-only, or read/write, or guard pages that don't allow access. The smallest range will be the page size of the Win32 system your application is running on. You can specify the starting address of the addresses to be reserved or committed, or you can let the system determine the address. Once you've committed a range of addresses, you can access them with an ordinary pointer and later free them with the `VirtualFree`

function. Note that you cannot free a reserved page without freeing the entire block that was originally reserved by `VirtualAlloc`.

Other Win32 virtual-memory functions include `VirtualLock` (to lock memory), `VirtualQuery` and `VirtualQueryEx` (to return information about a block of memory), and `VirtualProtect` and `Virtu-`

Win16 Memory-Management Functions Not Ported to Win32

`AllocDStoCSAlias`

`AllocSelector`

`ChangeSelector`

`FreeSelector`

`GetCodeInfo`

`GlobalDOSAlloc`

`GlobalDOSFree`

`GlobalNotify`

`GlobalPageLock`

`GlobalPageUnlock`

`LimitEMSPages`

`LocalInit`

`SwitchStackBack`

`SwitchStackTo`

Figure 4: These Win16 memory-management functions haven't been ported to Win32 and should be removed from your code before porting to Win32.

`alProtectEx` (to change a block's access attributes to read/write, read-only, or no-access).

THE WIN32 HEAP FUNCTIONS On Windows NT, Win32 limits every process to 65,535 objects, which includes memory objects, handles, and so on. If you allocate a large number of small memory blocks, you could easily run into this limit (in a 2GB address space, this isn't inconceivable). Consider the database buffering example I used above: What if you instead were to reserve space for 20,000 records, where each record contained a pointer or two to some additional dynamically allocated space? To avoid hitting a memory wall, Win32 provides a set of heap allocation functions, built on top of the virtual-memory functions. With these heap allocation functions, you can create an application-specific heap in your process's virtual address space and perform suballocations from it as needed. (Some Win16 development systems, such as Borland Pascal, already perform suballocation to get around limitations in Windows.)

Using the heap-allocation functions is easy. You use `HeapCreate` to create the heap, specifying the size of the initial set of committed memory and the maximum size that the heap can grow to. Under the hood, `HeapCreate` will make two calls to `VirtualAlloc`: The first will reserve a set of addresses the size of the maximum heap; the second will commit a set of read/write pages from those reserved addresses and create the initial heap. Since each heap has a header (192 bytes in Windows NT), the smallest heap size will be at least as big as the header. `HeapAlloc` will return a pointer to the newly allocated heap.

The private heap created by `HeapCreate` aggregates a set of virtual addresses into which the heap can then grow. You can then use `HeapAlloc` to suballocate memory objects from the heap, `HeapReAlloc` to change their sizes, `HeapSize` to return the size of an object, and `HeapFree` to return memory to the heap. If `HeapAlloc` requests a block of memory that's bigger than any available committed memory in the heap, some of the heap's reserved addresses will be committed to meet the heap allocation request. Once these addresses are committed, however, they can't be decommitted unless your application calls `HeapDestroy` to destroy the heap or the process terminates.

Because memory allocated by `HeapAlloc` is not movable, Win32 can't compact a private heap, and thus the heap can become fragmented. But the big advantage of using the private heap functions is to add to what the virtual-memory functions do: An application can reserve a set of addresses, be assured that a contiguous space is available in its own address space, and have a set of functions that make it easy to access and subdivide that space.

CONCLUSION As you've seen, many of Win32's best features, including heap management and virtual memory, are really just operating-system-level features that have been exposed for use by applications written to the Win32 specification. With an understanding of Win32 memory management, you'll be ready to use Win32 to write more powerful, simpler applications that take advantage of the Windows environments available today and in the future. □

RICHARD HALE SHAW IS A CONTRIBUTING EDITOR OF PC MAGAZINE.

Utilities

BY NEIL J. RUBENKING

DiskPie Targets Disk Space Consumers

No matter how big your hard disk is, you'll eventually fill it up. If you want to add a new application or create new data files, you'll have to clear out some old files first. DiskPie helps you identify the biggest consumers of disk space. Its pie-chart windows break down the space used by files in and below a particular directory in two ways. One type of pie window categorizes files by extension, the other by subdirectory. Do WAV files occupy 40 percent of the space in and below your Windows directory? Is more than half of your C: drive devoted to C:\GAMES? DiskPie will tell you.

You can download all the files necessary to run DiskPie from our on-line service, PC MagNet, or you can get them by mail. For details, see the sidebar "Guide to Our Utilities & How to Get Them." If your system has Visual Basic, Version 3.0, Professional Edition, you can simply download DISKPI.ZIP from Library 2 of the Utilities/Tips Forum on PC MagNet. Otherwise, from the same library, download the file DISKP.ZIP, which includes a number of VB support files required by DiskPie. You'll also need the main Visual Basic support library VBRUN300.DLL, available as VBRUN3.ZIP in Library 10 of the Utilities/Tips Forum. Complete source code for DiskPie (including the source for the help system) is in the file DISSRC.ZIP, available from Library 2 of the Programming Forum on PC MagNet.

To install DiskPie on a system that has VB 3.0 Professional loaded, simply unzip

DISKPI.ZIP into the directory of your choice and add DISKPI.EXE to a Program Manager group. If VB 3.0 Professional is not on your system, unzip DISKP.ZIP into the directory of your choice and then move GRAPH.VBX, CMDIALOG.VBX, GSW.EXE, and GSWDLL.DLL into your Windows system directory (usually C:\WINDOWS\SYSTEM). Put VBRUN300.DLL in the Windows system directory too, if it isn't already present. Add DISKPI.EXE to a Program Manager group, and you're ready to go!

USING DISKPIE The first time you run DiskPie, it will briefly display a pie chart with 14 slices of the same size, each a different color. DiskPie reads the color of each slice and stores the color values in a

list in its initialization file, DISKPIE.INI. When you mouse-click on a pie window, DiskPie checks the color of the pixel at the mouse cursor against this list of colors to see which pie slice you clicked.

To get a feel for how DiskPie works, choose New Dir Window from the Window menu. In the resulting Choose Directory dialog box, first pick the drive you want to examine. Now move around the directory structure by double-clicking on directories in the directory list box and choose a directory with at least one subdirectory. When the directory you want is displayed at the top of the dialog box, press OK to select it.

DiskPie will scan the files in the chosen directory, in its subdirectories, in *their* subdirectories, and so on. The status bar at the bottom of the main program window keeps you apprised of which directory is being scanned. When the process is complete, DiskPie displays a directory pie window like the one shown in Figure 1. The label for each slice tells what percentage that slice is of the whole, and the color legend at the right links each slice with its subdirectory.

Now try New Ext Window, also on the Window menu, and again select a directory using the Choose Directory dialog box. This time as DiskPie processes the directories, the status bar reports the number of different extensions found as well as the directory being scanned. When the scan is finished, DiskPie displays an extension pie window like the one in Figure 2. DiskPie can have up to nine pie windows open at once.

In both types of pie windows, the slices are ordered from largest to smallest, going counterclockwise from the twelve o'clock position. If there are more slices than the user-defined maximum (which defaults to 14), DiskPie will merge the smallest slices into one slice named OTHER. Any slices whose files occupy no disk space are eliminated.

If you click on the maximize box in the upper-right-hand corner of a pie window, it will expand to fill the interior of the main DiskPie window. Click on the minimize box to the left of the maximize box and the pie window will shrink to an icon. (The icon for a directory pie window is a slice of pie with a tree on it—to represent the directory tree—and the icon for an ex-

Top 10 Utilities

Rank	Utility
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6	DRVLOAD - Installs device drivers
7	PCTODAY - Lists files with current date
8	BUGS - Windows 3.1 screen saver
9	FINDIRQ - Locates available IRQs
10	PRN2FILE - Captures printer output

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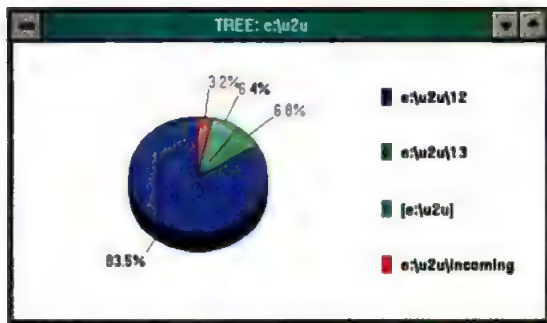


Figure 1: In this directory pie, files in the base directory e:\u2u make up 8.4 percent of the total disk space.

tension pie window is simply a slice of pie with the letters EXT.) Like Program Manager, DiskPie has options on its Window menu that let you cascade or tile the open pie windows or arrange the icons of the minimized ones.

Click on a pie slice with the mouse, and DiskPie will display detailed information about that slice on its status bar. The circle at the left of the status bar changes to the color of the slice, and the status-bar text shows the directory or extension for this slice, the actual number of bytes used, and the slice's percentage of disk usage. This is especially handy when the pie window is small and the text hard to read. Keyboard enthusiasts can press the Spacebar repeatedly to display each slice in the active pie window on the status bar.

If the active window is a directory pie, you can use the mouse or the keyboard to open a new window in order to analyze any of its slices. Simply double-click

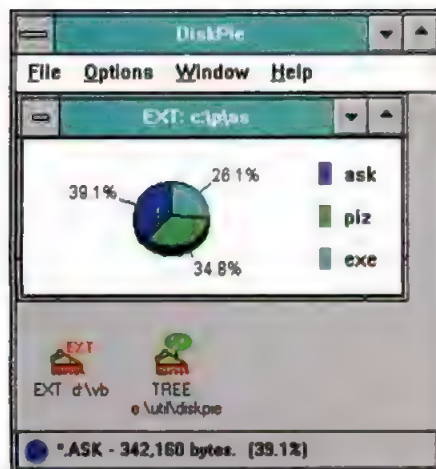


Figure 2: DiskPie's pie-chart windows break down disk-space usage by directory or by file extension.

on the slice or press the Spacebar until the slice's name appears on the status line, and then press Enter. If the selected directory has any subdirectories, DiskPie will use it as the base for a new directory pie. Otherwise, it will create an extension pie.

DISKPIE'S MENUS Now let's look at some of DiskPie's menu choices in detail. Note first that the contents of the File and Window menus are different depending on whether any pie windows exist. With no pie windows, the File menu contains only Get Colors and Exit.

You can select Get Colors at any time to invoke the routine that stores the 14 possible slice colors. DiskPie runs this routine automatically if it doesn't find the slice colors in DISKPIE.INI or if the Windows display driver has changed since the last time DiskPie was executed. If you find that DiskPie doesn't seem to recognize your mouse clicks, however, try refreshing the stored slice colors by selecting Get Colors.

When at least one pie window is present, the File menu expands to include Print and Print Setup. Print Setup simply calls up Windows' own print-setup dialog, which allows you to select a printer, set its options, and choose to print in either Portrait or Landscape mode. Landscape mode works best for DiskPie's charts. Choosing Print will print the active window on the selected printer. The VB graph control handles printing itself, automatically changing colors to black-and-white crosshatched patterns. DiskPie enhances the printed display by adding title lines identifying the program and the base directory (see Figure 3). DiskPie replaces the percent labels with simple index numbers, prefixes the legends with the corresponding index numbers, and adds total size and percentage information to the legends. DiskPie maximizes itself and the active window for printing and returns to normal size afterward.

The Options menu lets you control the maximum number of slices in a pie window and determine whether DiskPie will save its layout on exit. To set the number of slices, choose Maximum Slices, and then click on the desired number. The absolute maximum is 14, because the VB graph control uses 16 colors, and each slice must be a different color other than black or white. If you find that a pie chart with 14 slices is too busy, set the maximum number to a lower value. The new maximum will affect all pie windows created after the change but will not affect pie windows already created.

When the Save Layout on Exit menu choice is checked, DiskPie saves layout information to the file DISKPIE.INI before shutting down. This information includes the size and position of the main program window and the size, position, and graph data for each pie window.

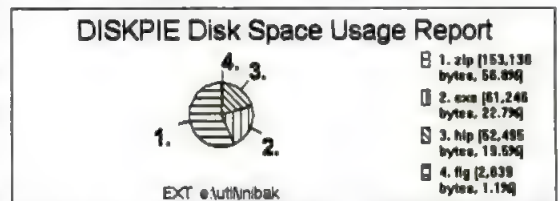


Figure 3: When DiskPie prints a chart, it replaces color with crosshatching and adds more information to the legend for each slice.



Figure 4: In the pie on the left, the labels for the smallest slices overlap, making them impossible to read. On the right is the same pie with the slices balanced to avoid overlapping labels.

Next time you start DiskPie, it will position itself according to the saved layout information and re-create the saved pie windows. If this menu choice is not checked, changes made to the layout during a session with DiskPie will not be saved on exit.

If no pie windows are open, the Window menu includes only the two choices discussed above: New Dir Window and New Ext Window. When at least one pie window is open, other choices appear.

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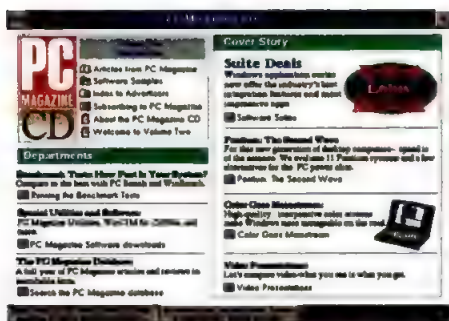
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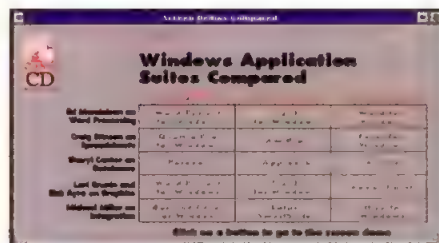
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Form_Load()

```

Sub Form_Load ()
    LocalDir2Use = Dir2Use
    Screen.MousePointer = HOURGLASS
    ' In case this is the first child form,
    ' synch the child form menu with the main menu.
    mnu_Slice(NumSlices).Checked = True
    mnu_Options(0).Checked = SaveSettings
    SliceShown = -1
    NumOpenWindows = NumOpenWindows + 1
    MdiForm1.Shapel.FillColor = &HFFFFFF
    GraphReady = False
    ' Initialize the child form in one of four ways.
    If LocalDir2Use = "GETCOLORS" Then
        LoadGetColors
    Else
        If InStr("012345678", LocalDir2Use) > 0 Then
            LoadFromINI
        Else
            Typ = Left$(LocalDir2Use, 1)
            LocalDir2Use = Mid$(LocalDir2Use, 2)
            If Typ = "T" Then
                LoadDirData
            End If
        End If
    End If
End Sub

```

```

Else
    Icon = Graph1.DragIcon
    HelpContextID = 18
    LoadExtData
End If
End If
MdiForm1.Label1.Caption = ""
GraphReady = True
' If the window was created correctly,
' have the Graph draw itself, then copy the
' resulting picture to the picture box
If (Caption <> "ERROR") And (Caption <> "Get Colors") Then
    Picture1.Visible = True
    Refresh
End If
Screen.MousePointer = DEFAULT
LocalDir2Use = ""
End Sub

```



Figure 5: The global variable Dir2Use determines how the Load method will initialize a child window.

LoadDirData()

```

Sub LoadDirData ()
    ' This function is called to initialize a new child window with
    ' Directory pie information.
    Dim N%, M%, Slices%
    Caption = "TREE: " + LocalDir2Use
    Show
    On Error GoTo BadPathDir
    Dir1.Path = LocalDir2Use
    On Error GoTo 0
    ' Add 1 to slices for "base" directory
    Slices = Dir1.ListCount + 1
    If Slices < 2 Then
        ' If there would be < 2 slices, switch to an extension pie
        Typ = "E"
        Icon = Graph1.DragIcon
        LoadExtData
        Exit Sub
    Else
        GrandTotal = 0
        Graph1.ThisSet = 1
        Graph1.NumPoints = Slices
        ' Store data for each subdirectory right in Graph1. Note that
        ' Graph1 may well come to hold many more slices than specified
        ' by the NumSlices variable.
        Dim Siz%
        For N = 0 To Dir1.ListCount - 1
            Graph1.ThisPoint = N + 1
            Siz = SizeOfFiles(Dir1.List(N), True)
            Graph1.GraphData = Siz
            GrandTotal = GrandTotal + Siz
            Graph1.LegendText = Dir1.List(N)
        Next N
        ' Insert a slice for the base directory
        Graph1.ThisPoint = Slices
        Siz = SizeOfFiles(LocalDir2Use, False)
        Graph1.GraphData = Siz
        GrandTotal = GrandTotal + Siz
        Graph1.LegendText = "[" + LocalDir2Use + "]"
    End If
End Sub

```

```

If GrandTotal = 0 Then
    Msg = "There are no files in or below " + LocalDir2Use
    MsgType = MB_ICONSTOP
    MsgBox Msg, MsgType, MsgTitle
    Caption = "ERROR"
    Exit Sub
End If
MdiForm1.Label1.Caption = "Sorting..."
SortDirData
EliminateZeros
' If there are too many slices, merge smallest ones into "OTHER"
If Graph1.NumPoints > NumSlices Then
    Dim OtherSiz!
    OtherSiz = 0
    For N = NumSlices To Graph1.NumPoints
        Graph1.ThisPoint = N
        OtherSiz = OtherSiz + Graph1.GraphData
    Next N
    Graph1.NumPoints = NumSlices
    Graph1.ThisPoint = NumSlices
    Graph1.GraphData = OtherSiz
    Graph1.LegendText = "OTHER"
End If
' Give each slice the color of its slice number, so DiskPie can
' identify slices by grabbing the color of a pixel.
For N = 1 To Graph1.NumPoints
    Graph1.ThisPoint = N
    Graph1.ColorData = N
Next N
Exit Sub
' Error handling code follows, in case this subroutine received an
' invalid directory.
BadPathDir:
Caption = "ERROR"
Msg = LocalDir2Use + " is not a valid path."
MsgType = MB_ICONSTOP
MsgBox Msg, MsgType, MsgTitle
Exit Sub
End Sub

```



Figure 6: Subroutine LoadDirData initializes a directory pie window.

Cascade, Tile, and Arrange Icons behave like the corresponding items on Program Manager's Window menu. Cascade makes all open pie windows the same size and places each one on top of the previous one, offset downward and to the right so that the captions are visible. Tile makes each open pie window roughly the same size and arranges them to fill the DiskPie window with no overlap. Arrange Icons lines up the icons of any minimized pie windows, starting in the lower-left-hand corner of the main window and going left to right, bottom to top.

Once you create a pie window, it doesn't change if you add or delete files. Select Refresh Active Window, and DiskPie will rescan the disk to update the active pie window with current information. You can also select this item after changing the maximum number of slices in order to re-create the active window using the new maximum.

When DiskPie creates a pie window, it puts the slices in order from largest to smallest, starting at the twelve o'clock position and going counterclockwise. This can have the effect of jamming the

smallest slices together at the top and causing their labels to overlap. If there are at least three slices in the pie, choose Balance Slices from the Window menu and DiskPie will attempt to rearrange the active window's pie slices to avoid this overlap.

If the biggest slice takes up more than half the pie, the Balance Slices feature will simply move the second biggest slice to the last position, thus pushing the smallest slices closer to the three o'clock position and spreading their labels farther apart. If the biggest slice takes up

SizeOfFiles()

```

Function SizeOfFiles! (ByVal DirName$, ByVal Recurse%)
' Function to get size of files in directory DirName. If the
' parameter Recurse is TRUE, the function recursively sums files in
' directories below DirName.
Dim TotalSize!, OneSize!, N%, DirCombine$
MdiForm1.Label1.Caption = "Scanning " + DirName + "...
DoEvents
TotalSize = 0
If Right$(DirName, 1) = "\" Then
    DirCombine = DirName
Else
    DirCombine = DirName + "\"
End If
File1.Path = DirName
File1.Pattern = *.*
File1.Refresh
' Add the size of each file in the current directory
If File1.ListCount > 0 Then
    For N = 0 To File1.ListCount - 1
        TotalSize = TotalSize + FileLen(DirCombine + File1.List(N))
    Next N

```

```

End If
If Recurse Then
    ' Use Dir2 to get a list of subdirectories
    Dir2.Path = DirName
    Dir2.Refresh
    If Dir2.ListCount > 0 Then
        ' Copy the list of subdirectories to a LOCAL variable
        Dim Dirs$( )
        ReDim Dirs$(Dir2.ListCount - 1)
        For N = 0 To Dir2.ListCount - 1
            Dirs(N) = Dir2.List(N)
        Next N
        ' For each subdirectory, call SizeOfFiles
        For N = 0 To UBound(Dirs)
            TotalSize = TotalSize + SizeOfFiles(Dirs(N), True)
        Next N
    End If
End If
SizeOfFiles = TotalSize
End Function

```



Figure 7: The recursive function SizeOfFiles reports the size of all files in and below the specified directory.

LoadExtData()

```

Sub LoadExtData ()
' This function is called to initialize a new child window with
' Extension pie information.
Dim N%, M%, Slices%, Temp$
Caption = "EXT: " + LocalDir2Use
Temp = "Scanning " + LocalDir2Use + ". 0 extensions found."
MdiForm1.Label1.Caption = Temp
List1.Clear
On Error GoTo BadPathExt
File1.Path = LocalDir2Use
File1.Refresh
On Error GoTo 0
GetExtensionData (LocalDir2Use)
Slices = List1.ListCount
If Slices > NumSlices Then Slices = NumSlices
If Slices < 2 Then Slices = 2
GrandTotal = 0
Graph1.ThisSet = 1
Graph1.NumPoints = Slices
MdiForm1.Label1.Caption = "Sorting..."
' Sort the data simply by copying it to List2 with the size FIRST
List2.Clear
Dim TheLine$
For N = 0 To List1.ListCount - 1
    TheLine = List1.List(N)
    List2.AddItem Right$(TheLine, 10) + Left$(TheLine, 4)
Next N
' Put the biggest items into the graph
For N = 1 To Slices
    Graph1.ThisPoint = N
    Graph1.ColorData = N
    TheLine = List2.List(List2.ListCount - N)
    Graph1.GraphData = Val(Left$(TheLine, 10))
    GrandTotal = GrandTotal + Graph1.GraphData

```

```

Graph1.LegendText = Mid$(TheLine, 11, 3)
Next N
' Add the remaining items to the "OTHER" slice
Dim OneData!
If List2.ListCount > NumSlices Then
    Graph1.LegendText = "OTHER"
    For N = 0 To List2.ListCount - (Slices + 1)
        TheLine = List2.List(N)
        OneData = Val(Left$(TheLine, 10))
        Graph1.GraphData = Graph1.GraphData + OneData
        GrandTotal = GrandTotal + OneData
    Next N
End If
If GrandTotal = 0 Then
    Msg = "There are no files in or below " + LocalDir2Use
    MsgType = MB_ICONSTOP
    MsgBox Msg, MsgType, MsgTitle
    Caption = "ERROR"
    Exit Sub
End If
EliminateZeros
Exit Sub
' Error handling code follows, in case this subroutine received an
' invalid directory.
BadPathExt:
Caption = "ERROR"
Msg = LocalDir2Use + " is not a valid path."
MsgType = MB_ICONSTOP
MsgBox Msg, MsgType, MsgTitle
Exit Sub
End Sub

```



Figure 8: The child window's Load method calls LoadExtData to create a new extension pie window.

less than half the pie, DiskPie performs a balancing act. Starting with the second biggest slice, DiskPie adds slices to the right or left of the twelve o'clock position, always adding to the side with the smaller amount of total space. Then it puts the biggest slice in the remaining central position. With a little luck, this arrangement will balance the biggest slice at the bottom of the pie, and the smallest slices will be near the three o'clock and nine o'clock positions, where their labels don't overlap as much (Figure 4).

This balancing act doesn't work with every graph, however, and the slices end up in no particular order. To put things

back the way they were before balancing, select Sort Slices from the Window Menu. (This option replaces the Balance Slices option when the active window is balanced.) The balanced/sorted status of each pie window is stored with the layout information in DISKPIE.INI.

At the bottom of the Window menu, you'll find a list of all pie windows, with a check mark next to the active one. You can switch to a different window simply by selecting it from this menu. This is especially handy when you've maximized the pie windows.

The Help menu gives you access to DiskPie's extensive help system. Select Contents to jump to the Contents page,

Search for Help On... to bring up the standard topic-search dialog, or How to Use Help for instructions in using the Windows help system. The About DiskPie... choice displays a form showing DiskPie's copyright information and a variety of Windows system information. Highlight any menu item and press the F1 key for context-sensitive help.

PROGRAMMING DISKPIE DiskPie relies heavily on the Visual Basic 3.0 graph control. The most important parts of the program are devoted to supplying the graph control with data and getting around its limitations.

DiskPie's main form is an MdiForm, and the pie windows are all instances of a

GetExtensionData()

```
Sub GetExtensionData (ByVal DirName$)
' Recursive function, sums the sizes for the various file extensions
' in the current directory, then calls itself for each subdir.
Dim TotalSize!, OneSize!, N%, DirCombine$, Temp$
Temp = "Scanning " + DirName + ". "
Temp = Temp + Str$(List1.ListCount) + " extensions found."
MdiForm1.Label1.Caption = Temp
DoEvents
TotalSize = 0
If Right$(DirName, 1) = "\" Then
DirCombine = DirName
Else
DirCombine = DirName + "\"
End If
File1.Path = DirName
File1.Pattern = *.*
File1.Refresh
' File List box File1 contains a list of all files in current dir
Dim Posn%, Locn%, Ext$, OneSiz!, TotalSiz!
If File1.ListCount > 0 Then
For N = 0 To File1.ListCount - 1
Posn = InStr(File1.List(N), ".")
If Posn = 0 Then
Ext = " "
Else
Ext = Left$(Mid$(File1.List(N), Posn + 1), 3) + "."
End If
OneSiz = FileLen(DirCombine + File1.List(N))
Locn = LocationOf(Ext, List1)

If Locn = -1 Then
List1.AddItem Ext + Format$(OneSiz, "0000000000")
Else
TotalSiz = Val(Right$(List1.List(Locn), 10))
TotalSiz = TotalSiz + OneSiz
List1.RemoveItem (Locn)
List1.AddItem Ext + Format$(TotalSiz, "0000000000")
End If
Next N
End If
Dir2.Path = DirName
Dir2.Refresh
' Directory list box Dir2 now contains a list of subdirectories.
If Dir2.ListCount > 0 Then
' Copy the subdirectory list to a local array, because other
' instances of this recursive procedure will re-use Dir2
Dim Dirs$()
ReDim Dirs$(Dir2.ListCount - 1)
For N = 0 To Dir2.ListCount - 1
Dirs(N) = Dir2.List(N)
Next N
For N = 0 To UBound(Dirs)
GetExtensionData (Dirs(N))
Next N
End If
End Sub
```



Figure 9: The recursive function GetExtensionData categorizes all the files in and below the specified directory by extension and records the total size for each extension.

form called Child, whose MDIChild property is TRUE. DiskPie loads this child form in several different ways. DiskPie can create a directory pie window, an extension pie window, or the special window used to get the color values of the pie slices. Also, it can create a pie window based on information stored in DISKPIE.INI. The main program controls which type of window will be created by setting the global variable Dir2Use, and the child form's Load method (Figure 5) copies Dir2Use to a local variable and initializes the window based on the variable's value.

The child form has its own menu, which is active any time a child window exists, so the Load method sets the menu's number of slices and layout settings to correspond with the main window's menu. Then, depending on the value of LocalDir2Use, Load method calls one of four subroutines: LoadGetColors, LoadFromINI, LoadDirData, or LoadExtData.

LoadGetColors is an exercise in trigonometry—it creates a pie with 14 identical slices, calculates the location of a pixel within each, and stores the color of that pixel. LoadFromINI simply reads data from DISKPIE.INI and builds a pie window to match. The real action occurs in the LoadDirData and LoadExtData routines.

LoadDirData (Figure 6) creates a pie

window whose slices correspond to the base directory and its subdirectories. LoadDirData starts by filling the invisible directory list box Dir1 with the names of the subdirectories of the specified directory. If there are no subdirectories, it transfers control to LoadExt-

DiskPie's job is to display big consumers of disk resources, so 0-byte slices are a waste of time. A call to the EliminateZeros function gets rid of any such slices.

Data, which creates an extension pie instead. Otherwise, it initializes the graph control's NumPoints property to hold as many slices as there are subdirectories, plus one for the base directory itself.

Next, LoadDirData creates a pie slice for each directory on the list and passes the directory's name to the function SizeOfFiles (Figure 7) to get the size of all files in and below that directory. SizeOf-

Files displays the name of the directory it's scanning on the main form's status bar, then fills the invisible file list box File1 with the names of all files in the directory.

SizeOfFiles steps through the list of files, adding the size of each file to the total. The parameter Recurse is TRUE, so SizeOfFiles calls itself recursively to process each subdirectory of the specified directory. To do this, SizeOfFiles fills the invisible directory list box Dir2 with a list of the directory's subdirectories, and then copies that list into a local-array variable. This step is necessary because other recursive instances of SizeOfFiles will also use the directory list Dir2. SizeOfFiles then calls itself to get the size of the files in each subdirectory and adds the result to its total.

After processing all of the subdirectories, LoadDirData calls SizeOfFiles one more time for the base directory itself. This time it passes FALSE for the second parameter, so SizeOfFiles just returns the size of the files in the base directory without rescanning the subdirectories.

If the total size of all files in and below the base directory is 0, LoadDirData doesn't bother going any further. Otherwise, it calls the function SortDirData to put the slices in largest-to-smallest order. SortDirData uses the invisible sorted list box, List1, to perform the sorting. It left-

pads the slice's size with 0s to ten digits, appends the slice's directory name, and adds the result to List1. Then it assigns the now-sorted data back to the pie slices in reverse order.

DiskPie's job is to display big consumers of disk resources, so 0-byte slices are a waste of time. A call to the EliminateZeros function gets rid of any such slices. If the pie chart has more than the specified maximum number of slices, the next step is to merge the smallest slices into one slice called OTHER. Finally LoadDirData assigns each pie slice the color number corresponding to that slice's position in the pie chart.

The task of creating an extension pie is handled by the LoadExtData routine (shown in Figure 8), which passes the base directory to the recursive routine GetExtensionData (shown in Figure 9). GetExtensionData starts by reporting which directory it's scanning on the status bar, and it also displays the number of extensions found up to this point. It fills the invisible file list box File1 with the names of all files in the passed directory. For each file in-

cluded in the list, it extracts the extension and gets the file's size. If this is the first file recorded with the particular extension, GetExtensionData adds the extension and size to the sorted invisible list box, List1. The lines in List1 have the form EXT.#####, where EXT is the extension, left-padded to three characters with spaces, and ##### is the file size, left-padded with 0s to ten digits.

The binary search function LocationOf determines whether any files with the specified extension have been recorded. If they have been, it returns the index within the list of that extension's data; if not, it returns -1. To add the current file's size to an existing data line, GetExtensionData extracts the total size for that extension,

adds the new file's size, and updates the line in List1 using the new size. After recording the sizes for all files in the specified directory, GetExtensionData calls itself recursively for any subdirectories, using the same technique as the SizeOfFiles function discussed earlier.

The next step is to sort the list of extensions by size rather than by name. LoadExtData accomplishes this by copying the contents of List1 to another sorted invisible list box called List2, putting the size first on each line. LoadExt-

Data adds the largest slices to the pie chart and combines any that don't fit into an OTHER slice. Eliminating any 0-byte slices completes the task of creating an extension pie.

RESPONDING TO MOUSE CLICKS If DiskPie shows that directory C:\FOO, for example, takes two-thirds of your disk's space, chances are you'll want to see a breakdown of the directories in and below C:\FOO. Logically, double-clicking on the C:\FOO slice should bring up a new pie based on that directory. The VB graph control, however, doesn't provide any method for determining just where on the pie a click occurred. Adding this seemingly simple feature to DiskPie required some serious subterfuge.

If it were possible to get the color of the pixel at the mouse cursor, you could deduce which slice had been clicked. The graph control doesn't include a method to do this, but the more common picture-box control does. DiskPie solves the problem by putting a picture-box control on top of the graph control and copying the graph to the picture box every time it changes. You never see the graph control itself!

Picture1's MouseUp response method (shown in Figure 10) uses the picture box's Point method to get the color of the pixel where the mouse cursor is located. If this color matches one of the stored slice colors, the method sets the

*The VB graph control
doesn't provide any
method for determining
just where a click
occurred. Adding this fea-
ture to DiskPie required
some serious subterfuge.*

Picture1_MouseUp() and Picture1_DblClick()

```
Sub Picture1_MouseUp (Button As Integer, Shift As Integer, X As Single, Y As Single)
' If the user clicks the mouse, get the color of the pixel at the
' mouse pointer. If it matches one of the recorded slice colors,
' select that slice and display its data in the status bar. If it
' does not match and is not either white or black, warn the user
' to re-calibrate the colors.
If Not GraphReady Then Exit Sub
Dim Color%, N%, Found%
Color = Picture1.Point(X, Y)
Found = False
SliceShown = -1
For N = 1 To 14
    If Color = SliceColors(N) Then
        Graph1.ThisPoint = N
        SliceShown = N - 1
        Found = True
    End If
Next N
If Found Then
    MdiForm1.Label1.Caption = ReportString()
    MdiForm1.Shape1.FillColor = Color
End If
End Sub

Sub Picture1_DblClick ()
If Not GraphReady Then Exit Sub
' If this isn't a directory pie, exit immediately.
If Typ = "E" Then Exit Sub
If SliceShown > -1 Then
    Graph1.ThisPoint = SliceShown + 1
    If Graph1.LegendText = "OTHER" Then Exit Sub
    If Left$(Graph1.LegendText, 1) = "[" Then Exit Sub
    Dir2Use = "T" + Graph1.LegendText
    NewPie
End If
End Sub
```



Figure 10: The MouseUp method of the picture-box control uses color to identify which pie slice was clicked; the DblClick method opens a new pie window if the clicked slice was in a directory pie.

pie window's SliceShown variable to match, and sets the variable Found to TRUE. If the color was found in the list of slice colors, the MouseUp method puts detailed information about the selected slice on the status bar and sets the color circle on the status bar to the slice's color.

A double click is always preceded by a single click, so the picture box's dou-

ble-click response method can rely on MouseUp setting the value of SliceShown. If this is a directory pie and the selected slice is neither the base directory slice nor the OTHER slice, the double-click response method loads a new directory pie based on the selected slice.

DiskPie hasn't come close to exhausting the abilities of the VB graph control.

This control can display a variety of other graph types, including bar, line, area, and even Gantt charts. The pie-chart feature, however, is all DiskPie requires to make very clear what directories and what extensions are hogging your valuable disk space. □

NEIL J. RUBENKING IS TECHNICAL EDITOR OF PC MAGAZINE.

GUIDE TO OUR UTILITIES & HOW TO GET THEM

DiskPie

PURPOSE: DiskPie is a Windows program that uses pie charts to give you a graphic view of what's taking up space on your hard disk. When you mouse-click on a slice, information about that portion of your hard disk is on the status bar.

SETUP: DiskPie uses the Visual Basic 3.0 runtime DLL and various other support files. To install DiskPie on a system that has Visual Basic, Version 3.0, Professional Edition, loaded, simply unzip DISKPI.ZIP into the directory of your choice and add DISKPIE.EXE to a Program Manager group.

If VB 3.0 Pro is not on your system, unzip DISKPI.ZIP into the directory of your choice and then move GRAPH.VBX, CMDIALOG.VBX, GSW.EXE, and GSWDLL.DLL into your Windows system directory (usually C:\WINDOWS\SYSTEM). Put VBRUN300.DLL in the Windows system directory, too, if it isn't already present. Then add DISKPIE.EXE to a Program Manager group.

REMARKS: DiskPie can display two types of pie charts: directory (displays files by name) or extension (displays files grouped by extension). You select the type of pie chart from the DiskPie Window menu.

When you click on a pie slice, you get detailed information about that slice on the status bar. The circle at the left of the status bar changes to the color of the slice, and the status-bar text shows the directory or extension for that slice, the actual number of bytes used, and the percentage of the base directory this slice's files take up.

If you prefer to use the keyboard rather than the mouse, you can press the Spacebar to display each slice from the active window in turn.

If the active pie window is a directory pie, you can use the mouse or the keyboard to zoom in on any slices. To do this, simply double-click on the slice, or press the Spacebar until the slice's name appears on the status line and then press Enter. If the selected directory has subdirectories, DiskPie creates a new directory pie. Otherwise, it will create an extension pie.

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PC Solutions

TIPS AND TECHNIQUES TO INCREASE YOUR PRODUCTIVITY

Hardware

FINDING A NEW OLD KEYBOARD

❓My trusty old AT-style keyboard has served me well for over five years. I particularly appreciate its similarity to the IBM Selectric, which is the best keyboard ever invented for speed typists. I've never found an Enhanced keyboard that meets the same standard of convenient layout and compact size. Are there any manufacturers left that can supply new, AT-style keyboards?

Malcolm Dead
Los Angeles, California

►PC MAGAZINE: We could probably fill an entire issue of *PC Magazine* just describing all the different keyboards available today, and we'd never settle the controversy over which is the best. While there are a number of new Enhanced keyboards that use a layout similar to the original AT keyboard, why settle for less than the real thing? Fortunately, there are many sources for refurbished keyboards, and if you're lucky, you can still find unused keyboards available from surplus-equipment dealers. You can locate these dealers in advertisement publications, such as *Computer Hotline* (800-866-3241) or *Processor* (800-334-7443).

—Alfred Poor

GOING LOCAL

❓I have a 486DX/33 computer with an ISA bus. I'm interested in converting to a local-bus system to avoid the video bottleneck. What does this involve, and can it be accomplished easily and relatively inexpensively?

Patrick J. Caffrey
via fax

►PC MAGAZINE: What's involved here begins with a motherboard swap, and this is neither difficult nor expensive. Before proceeding, however, there are several points to consider.

First make sure that your system's performance is indeed being limited by the video. Depending on the applications you run, upgrading the CPU—with an Intel OverDrive coprocessor, for example—might provide broader performance benefits than just switching to local bus for the sake of the video. (The Intel OverDrive chips double the speed of the CPU's *internal* operations, but they don't change the speed of the external bus, to which the video will remain attached.)

If you determine that local bus is what you need, you can buy a replacement motherboard without a CPU for \$150 or less. VESA VL-Bus motherboards currently carry only about a \$10 premium over ISA designs. Before settling on a replacement motherboard, check to make sure that it will accept both your current CPU and your current memory (both system memory and secondary cache, if you have any installed). Having to buy either new memory or a new CPU will drastically affect the cost of your upgrade.

To take advantage of the enhanced VL-Bus performance, you'll also need to replace your graphics adapter. Depending on your preferences for brand and chip set, an equivalent replacement for your current card will cost \$100 and up.

You may be able to recover some of your costs by selling the replaced parts, but it could prove difficult to find a buyer for them at a price that makes this worth your time and effort. Assuming that you don't sell the surplus parts, your upgrade project will cost you at least \$200, even if you install the replacement board yourself.—Alfred Poor

SHRINKING ICONS

❓I just added a CD-ROM drive to my 486DX/33 system. When I use the drive with the video set at 800-by-600 resolution with 256 colors in Windows, the images are beautiful, but the icons and other Windows items shrink and the system performance slows perceptibly. If I switch back to the standard VGA settings, the size of the Windows items returns to normal and the performance improves, but the CD-ROM graphics deteriorate. What am I doing wrong?

James A. Anderson
San Marino, California

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PC DIRECT starts here with exciting offers from top direct vendors.

See index, page 314.

► **PC MAGAZINE:** Unfortunately, you're probably doing everything right. You've simply run into another computer application of TANSTAAFL: There Ain't No Such Thing as a Free Lunch. If you increase resolution and color depth, performance will suffer, because you have to move more information around. Your best bet for a solution may be to compromise by using 640-by-480 resolution with a 256-color driver (assuming your graphics adapter provides one). Let's look at these points one at a time.

Many readers have asked why their Windows items shrink at increased resolutions. The reason is that these items are defined in terms of a fixed number of pixels, not in terms of proportions of the total display. If you pack the same number of pixels more closely together—thus increasing the resolution—the item gets correspondingly smaller. That's why some people feel that high-resolution modes are suitable for use only with large monitors. (Others, however, find that 1024-by-768 works very well on 14-inch screens in spite of small Windows items, such as icons. It's simply a matter of preference.) You can change the size (and font) of the Program Manager icon captions if you

wish, but you're stuck with the shrunken images.

Now consider the performance problem. A 640-by-480 screen has 307,200 pixels, and an 800-by-600 screen has 480,000 pixels. In 16-color mode, 1 byte stores 2 pixels, while in 256-color mode, 1 byte stores just 1 pixel. Thus, it takes 153,600 bytes to store a 16-color, 640-by-480 screen and 480,000 bytes to store a 256-color, 800-by-600 screen—more than three times as much information! When you demand three times as much of your system, something—specifically, performance—is bound to suffer.

Our Advisors

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M. David Stone is a contributing editor and coauthor of *Word for Windows Companion*, Second Edition.

Ethan Winer is a contributing editor and the author of *PC Magazine BASIC Techniques and Utilities*.

So what can you do? Try a middle-ground compromise. Though you don't specify in your letter, it's likely that your CD-ROM images are 256 colors, which is why they look better at the higher-resolution mode you chose. Many Super VGA cards come with drivers for 640-by-480 resolution at 256 colors. This requires only twice, not three times as much information per screen as the standard VGA image. You may find that this provides a more acceptable system performance, giving you all the color required by your CD-ROM with the added bonus of getting back your normal-size Windows elements.

—Alfred Poor

HOW TO CONTACT US

Do you have a hardware, software, or systems problem you can't solve? Do you have a tip you think other readers could use? Or maybe you'd like a better understanding of how something works. If so, we invite you to let us know about it. Our experts can give you practical solutions to your problems, provide techniques for using your software and hardware more productively, and help you grasp computer concepts and understand the latest technology.

It's easy to contact us. Just send us your submission (use ASCII format for text files) via the medium that's most convenient for you:

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For any tip we print, you'll receive \$50 plus a *PC Magazine* T-shirt. We regret that we cannot answer letters individually.

Operating Environments

MULTIPLE .INI FILES

❓ Sometimes I need to load Windows 3.1 with different WIN.INI and SYSTEM.INI configurations (for example, depending whether I will be connected to our network). Is there some way to get Windows to recognize the particular .INI file I need *without* editing or copying these files? Also, is there a way to manually restart Windows from within Windows, without going through the Exit procedure?

Nelson Sellers
Jackson, Mississippi

► **PC MAGAZINE:** Utilities that let you load alternative versions of AUTOEXEC.BAT and CONFIG.SYS are common, so you might expect to find something similar for WIN.INI and SYSTEM.INI. But there's

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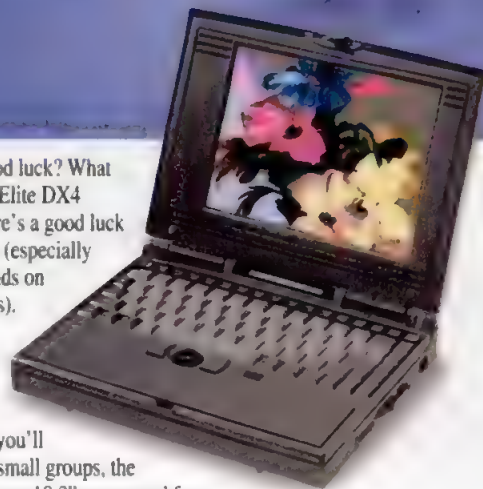
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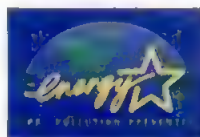
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an important difference between the DOS configuration files and the Windows system files. AUTOEXEC.BAT and CONFIG.SYS rarely change, and when they do, it's usually because you have changed them intentionally. WIN.INI and SYSTEM.INI, on the other hand, get changed frequently by Windows based on choices you make within Windows. If you "freeze" your .INI files and use the saved files later, you may lose some of those changes.

So how can you automate the process of changing your .INI files? Download the tiny program INI.EXE from Library 10 of PC MagNet's Utilities/Tips Forum. INI.EXE takes four parameters: an .INI filename, the name of the section in which you want to make a change, the name of the key to change, and the new value for the key or "nul" to remove the key. If any of the parameters contain blanks or other separators, simply enclose them in quotes. For example, to change your wallpaper to SPOTS.BMP, you'd use

```
INI WIN.INI desktop wallpaper
SPOTS.BMP
```

To add a line associating .SND files with the waveaudio device, you'd use

```
INI WIN.INI "mci extensions" SND
waveaudio.
```

Thus, instead of storing different versions of your WIN.INI and SYSTEM.INI files, you create batch files that change WIN.INI and SYSTEM.INI on the fly to suit your needs. If you're not sure just what those changes are, try this: Make copies of the two .INI files, then use Control Panel, Windows Setup, or whatever is necessary to create one of your configurations. Now use the DOS command FC (file compare) to see which lines in the .INI files changed.

As for restarting Windows without going through the normal procedure, it's important that all running applications get a chance to warn you if they're holding unsaved data. Utilities that let you exit Win-

dows as quickly as possible, however, are easy to find. If you have access to CompuServe, you'll find a dozen in the WIN-SHARE Forum alone. In addition, you can find several utilities in the Windows & OS/2 Utls Library in PC MagNet's Utilities/Tips Forum. Many include options to exit quickly or restart Windows at the touch of a hotkey. Some even let you exit, run a DOS program, and then restart Windows. This last option is good for those games that just won't run under Windows!—Neil J. Rubenking

FASTER FORMATTING

When I format a floppy disk using the DOS 5.0 quick-format option, FORMAT tells me that it's saving unformat

FORMAT's /Q and /U Switches

	Neither	/Q	/U	Both
Check disk for bad sectors	Yes	No	Yes	No
Save UNFORMAT information	Yes	Yes	No	No
Overwrite data area	No	No	Yes	No

Figure 1: This shows how the /Q and /U switches affect the operation of the FORMAT command.

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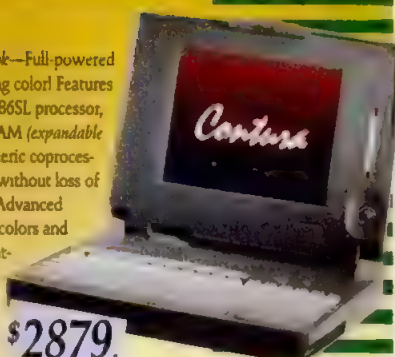
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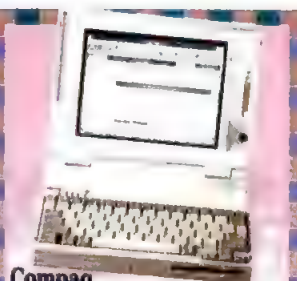
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information. Where is this information saved, and does it reduce the total amount of disk space I can use? Can I quick-format a floppy disk without being bugged about unformat information? When I have to format many floppy disks, the time wasted on this does add up.

*Rick Durso
Brewster, New York*

► **PC MAGAZINE:** The unformat information saved by FORMAT in DOS 5.0 and later consists of a snapshot of the disk's root directory and FAT (file allocation table). This doesn't reduce the total amount of disk space you can use. FORMAT copies the unformat information to an unused section of the disk; if the disk is completely full, FORMAT will report that it can't save unformat information. Then it clears the disk's root directory and FAT without touching the data area of the disk. The UNFORMAT command copies this snapshot back onto the root directory and FAT. UNFORMAT will work only if no changes have been made to the disk after the accidental formatting. If you copy new files to the disk, they can overwrite data belonging to old files, and unformatting will destroy both the old and the new files.

The important switches that allow you to speed up the operation of FORMAT are /Q (which stands for *quick*) and /U (for *unconditional*). The table in Figure 1 shows how these switches control three aspects of the formatting process. Overwriting the data area is the slowest of the operations—it requires FORMAT to write the value F6h to every byte of the disk's data area. Checking the disk for bad sectors is slightly faster, because FORMAT only has to *read* every sector. (You can skip the bad-sector check only for a disk that has already been formatted.) Saving unformat information is relatively quick compared with the other two operations, but if you know you won't want to unformat the disk, you can save time by skipping this option. As you can see from the table, FORMAT/Q/U skips all three of these optional processes for the fastest possible formatting.

—Neil J. Rubenking

Word Processing

SORTING FONT SAMPLES IN WINWORD 6.0

► **TIP:** The FontSamples macro in your December 21, 1993, Solutions column is useful for printing font samples if you're using Microsoft Word for Windows 2.0. Unfortunately, however, the macro will not work with WinWord 6.0, because Version 2.0's FormatCharacter com-

sort on the font names. I found that WinWord 6.0 had no trouble producing the font list, but WinWord 2.0 ran out of memory during the sort.

*Eliezer May
Rockville, Maryland*

► **PC MAGAZINE:** The publication of the original WinWord 2.0 font-sample macro so soon after WinWord 6.0 became available was an unfortunate accident in timing, as a number of readers discovered. Fortunately, Mr. May's modified version is well-commented and entirely ade-

FontSort Complete Listing

```
Sub MAIN
  nFonts = CountFonts()           ' Get number of fonts
  Dim FntName$(nFonts)           ' Reserve space for font names
  For count = 1 To nFonts         ' Load fonts into array
    FntName$(count) = Font$(count)
  Next
  LastSwitch = nFonts - 1         ' Calc repetitions of loop as
  While LastSwitch > 0            ' number of fonts -1
    Limit = LastSwitch            ' Set limit for loop as
    LastSwitch = 0               ' orig value of LastSwitch
                                ' Then sort

    For count = 1 To Limit
      If FntName$(count) > FntName$(count + 1) Then
        LastSwitch = count
        Temp$ = FntName$(count)
        FntName$(count) = FntName$(count + 1)
        FntName$(count + 1) = Temp$
      End If
    Next
  Wend

  For count = 1 To nFonts         ' Now print font information
    Font "Arial", 6              ' First set to Arial 6pt
    Insert Str$(count)           ' Print a number for the font
    Insert ". "                  ' Follow with period
    Insert FntName$(count)       ' Print font name in Arial
                                ' NOTE use FormatCharacter for
                                ' ver 2. FormatFont for 6.0
    FormatFont .Font = FntName$(count)
    FormatFont .Points = 12       ' Now set to 12pt
    Insert FntName$(count)       ' Print font name
    Insert " AaBcCdDdEeFf"      ' Print the sample text
    InsertPara                   ' End the line
  Next                           ' Continue to next font until
                                ' until done
End Sub
```

Figure 2: This font-sample macro for WinWord 6.0 will print samples of the fonts available on your system, sorting them alphabetically and numbering them as well.

mand was changed to FormatFont. A modified version of the macro, called FontSort, is shown in Figure 2. In addition to using WinWord 6.0 commands, the new macro both alphabetizes and numbers the font list. And as with the original macro, the new macro prints the font names in a printable font, which is important for listing symbol and foreign-language fonts.

One warning to WinWord 2.0 users is in order: The new macro uses a bubble

quote. Apart from the simple fix produced by changing FormatCharacter to FormatFont, its greatest interest lies in the sorting mechanism, which you may want to work through in detail so you can borrow the logic for other macros. You may also want to modify the New-FontSample macro that also appeared in the December 21, 1993, issue, since that macro prints more characters in each font and breaks the font samples more widely apart.





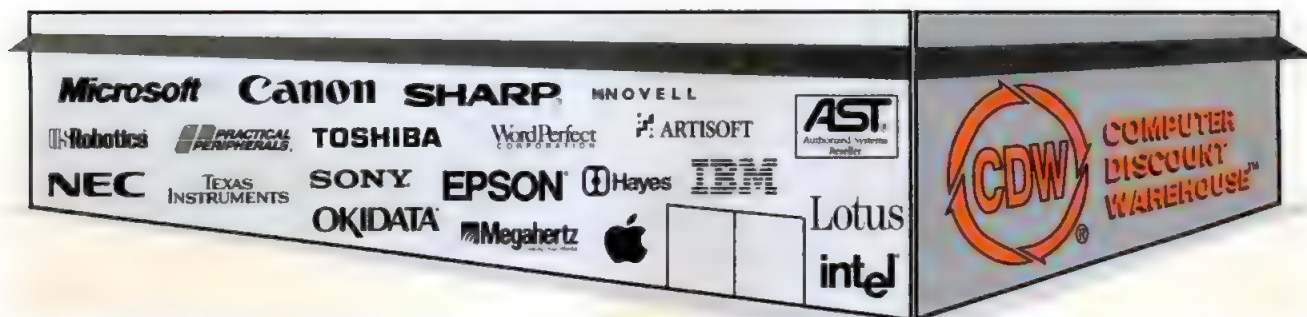
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PPX03 POCKET PORT MULTIPLEXOR	77.80
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IBM TOKEN RING 16/4	450.88

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ETHEREXPRESS 16 COAX 5PK	454.13
ETHEREXPRESS 16 COAX 20PK	454.13
ETHEREXPRESS MCA COAX	149.92
ETHEREXPRESS 16 10BT	149.92
ETHEREXPRESS 16 10BT 20PK	149.92
ETHEREXPRESS MCA 10BT	149.92
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PLEXTOR 3028 W/PA SPECTRUM 16	CALL1
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LC 4335 120MB	1882.77
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TM4000E SX/25 200MB PAS COLOR	2677.44
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ML385	689.32	OL810	905.50
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SuperScript 610	567.78	Stentwriter 95F	867.70
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- ◆ 200MB IDE Hard Drive
- ◆ Parallel, Serial, External Keyboard and Video Ports
- ◆ 10" Monochrome LCD, 64 Gray Scales
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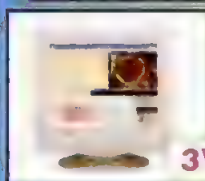
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Mr. May's modification raises the more general question of how to port WinWord 2.0 macros to WinWord 6.0. You have two choices. One is to compare the commands in the two versions of WinWord and make the appropriate changes in the macro as you enter it—in this case, changing FormatCharacter to FormatFont.

Assuming you already have a working WinWord 2.0 macro stored in a WinWord 2.0 template, your other choice is to let WinWord do the conversion for you. You can, for example, update an entire WinWord 2.0 template at once—including all macros stored in that template—by attaching the template to a WinWord 6.0 document. Or if you prefer, you can convert a single macro.

The technique for moving individual macros from WinWord 2.0 to WinWord 6.0 takes advantage of the WinWord 6.0 Organizer and is identical to moving macros from one WinWord 6.0 template to another. First, open a document in WinWord 6.0, choose File | Templates, and then Attach to that document the template into which you want to move the macro.

Next, with the Templates and Add-ins dialog box still open, choose the Organizer button and move to the Macros card in the Organizer dialog box. The card includes two list boxes, which show the available macros. If you have only the Normal template attached, both boxes will show that template's contents. Otherwise, there will be one for the Normal template and another for the attached template.

In either case, choose the Close File button on one side so that the remaining list is for the template you want to serve as the macro destination. Then choose the Open File button (which replaces the Close File button on the screen) and use the Open dialog box to designate the appropriate WinWord 2.0 template to open. (The Open dialog box looks and works much like the Open dialog box that you see when you choose File | Open.)

At this point, you should see a list box showing the macros in the WinWord 2.0 template file on one side of the dialog box and a list box showing macros in the WinWord 6.0 template file on the other side.

Use the mouse or keyboard to highlight the macro or macros in the WinWord 2.0 template that you want to convert to WinWord 6.0 and choose the Copy button. WinWord will copy them to the WinWord 6.0 template, converting them in the process. You can then close the Organizer dialog box, return to your document, and use the updated macros. If you copied the macros to any template other than Normal, WinWord will ask whether to save the changes to the template. If you copied them to the Normal template, you choose File | Save All to save the changes.

Unfortunately, however, although the automatic conversion procedure almost always works for simple macros and works often enough to be useful for more complicated ones, it doesn't always do an adequate job. Even when it doesn't work, it does provide a start, so there's less for you to do to get the macro working. But you must always test converted macros carefully.

One thing you'll note is that the automatic-conversion procedure does not directly replace the old commands with their WinWord 6.0 counterparts. FormatCharacter, for example, does not get changed to FormatFont. Rather, the conversion process adds WW2_ to the commands; FormatCharacter becomes WW2_ FormatCharacter, which WinWord 6.0 treats as the functional equivalent of FormatFont.

If you want to increase the odds that your macros will remain useful with future WinWord versions, you may want to work through the converted macros, changing the commands to their WinWord 6.0 equivalents. The WW2_ markers will serve as a guide to which commands need changing, but you should also be aware that WinWord adds the WW2_ in some cases where it's not needed. In the original version of the font-sample macro, for example, the conversion will change the Insert command to WW2_Insert, even though the Insert command written for WinWord 2.0 will work without problems in WinWord 6.0.

You can download the FONTSORT macro from PC MagNet's Utilities/Tips Forum. Look for the file FONTSO.ZIP.—*M. David Stone*

Spreadsheets

TOGGLING A WORKSPACE COMMAND

TIP I frequently use Microsoft Excel 4.0's Move Selection after Enter option, which can be found in the Options menu's Workspace command. With this option selected, you can move down a row just by hitting Enter instead of the Down Arrow key. This is handy for those who use the numeric keypad for entering data into columns. But I often found it awkward to access this feature from the menu, so I wrote the following simple macro to toggle the feature on or off from the keyboard:

```
=WORKSPACE(,,,,,,"/","NOT(GET.  
WORKSPACE(46)),1,,,1,,)
```

The commas are placeholders for other settings in the Options Workspace dialog box. GET.WORKSPACE(46) returns the current state of the move-on-enter option. Preceding this function with NOT causes the macro to change the state: It toggles from off to on or vice versa.

I've assigned the Ctrl-M hotkey to this macro and stored it in the file GLOBAL.XLM. Now whenever I want to switch the move-on-enter feature on or off, I simply press Ctrl-M.

*Al Stirling
Calgary, Alberta, Canada*

PC MAGAZINE: Finding your way to a particular check box in one of Excel's Options dialog boxes is time-consuming, and you can bet it's only going to get more so as Excel continues to evolve. Therefore, any option you find yourself turning on and off regularly is an excellent candidate for a macro.

Mr. Stirling's macro represents one good strategy: Build the macro as a toggle, using NOT() in conjunction with the appropriate GET.WORKSPACE function. Assign a memorable keyboard shortcut and store the macro in your global macro document.

If you always use a particular option setting with a particular document and

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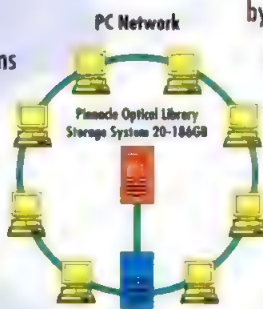
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have moved to Excel 5.0, you might want to try the following alternative strategy: Insert an .XLM sheet or a .VBA module into the document and create two macros—one named Auto_open, the other named Auto_close. Let Auto_open set the option as you want it for this document and have Auto_close toggle it the other way. Each time you open the document in question, the option will be set correctly for that document. When you close the document, the option will be reset to its former state.

For example, suppose you like the move-after-return feature for data-entry purposes but not for other kinds of spreadsheet work. Putting an Auto_open macro that turns this feature on in each data-entry workbook will simplify your data entry. Including an Auto_close macro to turn the feature off will ensure that your other Excel documents also behave as you expect.

In Visual Basic, Applications Edition, Mr. Stirling's toggle macro would look like this, assuming it was named MAR_Toggle:

```
Sub MAR_Toggle()
    Application.MoveAfterReturn =
        Not (Application.MoveAfterReturn)
End Sub
```

The Auto_open/Auto_close approach would produce the following code:

```
Sub Auto_open()
    Application.MoveAfterReturn =
        True
End Sub
```

```
Sub Auto_close()
    Application.MoveAfterReturn =
        False
End Sub
```

To use the Auto_open/Auto_close technique in Excel 4.0, open a new macro sheet and enter the following code:

```
Auto_open
=WORKSPACE(,,,,,"/,,,1,1,,,1,,)
=RETURN()
```

```
Auto_close
=WORKSPACE(,,,,,"/,,,0,1,,,1,,)
=RETURN()
```

Name the first block of code Auto_open and the second Auto_close and designate each as a command macro. Enclose both the macro sheet and the worksheet you want it to affect in a workbook document (.XLW) and save.

—Craig Stinson

Databases

MAXIMIZING A WINDOW IN PARADOX FOR DOS

TIP Users new to PAL or who are moving up to Paradox 4.x frequently ask me how to maximize a window in Paradox for DOS. The MaxWin() procedure shown in Figure 3 will do the trick. It first removes the annoying and often unnecessary scroll bars and frame if you're displaying a form, and then it increases the size of the current window to fill the desktop.

The opening line of the code,

```
WINDOW HANDLE CURRENT TO
winhndl
```

stores the handle of the current window in the variable winhndl. The window handle is a unique numeric ID that Paradox assigns to each window it creates. Using this value with certain commands tells Paradox which window to work on.

The next line,

```
DYNARRAY winatts[]
```

declares a dynamic array named winatts, which will hold the attributes

to be applied to the window.

The array's MAXIMIZED element is set to True by the line

```
winatts["MAXIMIZED"] = TRUE.
```

The succeeding IF. .ENDIF block sets the array's HASFRAME element to False in order to remove the frame and scroll bars from the window if that window contains a form.

Finally, the line

```
WINDOW SETATTRIBUTES winhndl
FROM winatts
```

takes the values stored in the array and applies them to the current window.

Chris Borgers
Reynoldsburg, Ohio

► **PC MAGAZINE:** The windowing capabilities introduced in Paradox 4.0 for DOS and enhanced in Paradox 4.5 greatly expand what you can do when building PAL applications with the user interface. Several commands that start with WINDOW (WINDOW CREATE, WINDOW CLOSE, WINDOW HANDLE, and so forth) plus a number of functions, many of which begin with the letters WIN, supply most of this new functionality. For an overview of the windowing system, see chapter 11, "Using Windows," in the *PAL Programmer's Guide*.

Associated with each window created by Paradox for DOS is a set of descriptive attributes. These attributes include the row and column origin, the height and width, the title, whether the window has a shadow, and a long list of other attributes

MAXWIN() PROCEDURE

Complete Listing

```
;
;
; PROC MaxWin() - Maximize the current window Paradox for DOS 4.5
;
PROC MaxWin()
    WINDOW HANDLE CURRENT TO winhndl
    DYNARRAY winatts[]
    winatts["MAXIMIZED"] = TRUE
    IF ISFORMVIEW() THEN
        winatts["HASFRAME"] = FALSE
    ELSE
        winatts["HASFRAME"] = TRUE
    ENDIF
    WINDOW SETATTRIBUTES winhndl FROM winatts
ENDPROC
```



Figure 3: The MaxWin() procedure can be called from your PAL scripts to maximize the current window. It also removes the scroll bars and border if the window is displaying a form.

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Bravo NB



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486DX/2/66	345MB	\$1699

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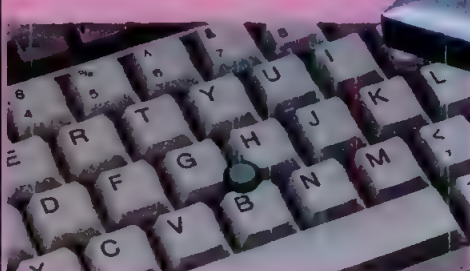
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\$3999*



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- ▲ 4MB RAM, expandable to 20MB
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- ▲ 82-key keyboard
- ▲ MS-DOS, Windows 3.1
- ▲ Ballpoint mouse 2.0 with Quickport
- ▲ Enhanced power management

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\$1499

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- ▲ Type III PCMCIA slot
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- ▲ MS-DOS, Windows 3.1
- ▲ Ballpoint mouse 2.0 with Quickport
- ▲ Enhanced power management

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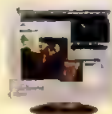
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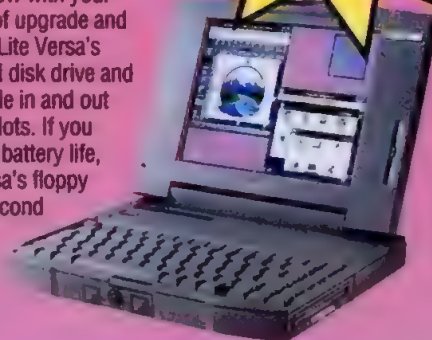
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DX2/50	Active color	209MB	\$4499
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386DX/33	212MB	\$1399
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- ▲ IBM® DOS 6.1, MS Windows 3.1, mouse

Processor	Hard Drive	Price*
486SX/33	170MB	\$1359
486DX/33	212MB	\$1559
486DX/33	340MB	\$1719
486DX2/66	340MB	\$2159

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- ▲ IBM® DOS 6.1, MS Windows 3.1, mouse

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8MB	527MB	\$2699

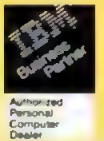
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MAXWIN10 PROCEDURE

Complete Listing

[illegible]

Figure 4: Functionally similar to the MaxWin() procedure shown in Figure 3, MaxWin1() also checks for a valid current window handle before attempting to set the window attributes.

that are documented in the *PAL Programmer's Guide*. You can ask Paradox to put these values into a dynamic array, where you can examine and alter them. (You'll recall that a dynamic array is one whose size can be altered at runtime and which uses alphanumeric indexes.) You can then have Paradox use the values in the array to reset the attributes of the window.

For example, depending on whether

The windowing capabilities introduced in Paradox 4.0 for DOS greatly expand what you can do when building PAL applications with the user interface.

you get it or set it, the MAXIMIZED window attribute either reports or determines whether the current window is maximized. Simply to get the window attributes, you use the WINDOW GETATTRIBUTES command; Mr. Borgers's function uses the WINDOW SETATTRIBUTES command to set the window attributes.

USING MINIScript Paradox's Miniscript feature lets you experiment with the various windowing commands and functions. Start up Paradox, select View, and choose a table so that you have a window to work with. With the table displayed, press Alt-F10 to activate the PAL menu and choose Miniscript. Paradox will then display the Miniscript window. Like the Command window in Microsoft FoxPro, the Miniscript window lets you enter, execute, and experiment with commands easily.

Before you can experiment with window attributes, you must get the window handle. Mr. Borgers's procedure in Figure 3 does this by using the `WINDOW HANDLE CURRENT TO` command, specifying a variable name for the handle. An alternative is to use the `GetWindow()` function to assign the handle to a variable. `GetWindow()` returns the same result as the `WINDOW HANDLE` command but can be used in expressions.

At this point, type the following text into the Miniscript window and hit Enter:

MESSAGE GetWindow()

This will give you the window handle for the table you viewed earlier. My machine displayed the number 3, but your machine may show a higher number as the handle that uniquely identifies the window.

To store the window attributes for the window with handle 3 to a dynamic array

(substitute your handle number for the 3 in the following), enter the following command into the Miniscript window:

WINDOW GETATTRIBUTES 3 TO attr

This creates a dynamic array named `attr` and fills it with the window attributes. You can now use the `MESSAGE` command to examine any of the window attributes. For example, try

```
MESSAGE attr["MAXIMIZED"]
```

On my machine, Paradox displayed False, because the window was not maximized.

Now try

MESSAGE attr["HEIGHT"]

Paradox displayed 18 on my machine, because the window (including the window frame) was 18 rows high. To change this value and have it affect the window, try entering the following two commands into the Miniscript window:

```
attr[*HEIGHT*]=4
WINDOW SETATTRIBUTES 3 FROM
attr
```

Paradox will redraw the window so that it's only four rows high. In the same manner, you can alter the **MAXIMIZE** attribute and have Paradox maximize the window:

```
attr["MAXIMIZED"]=True
WINDOW SETATTRIBUTES 3 FROM
attr
```

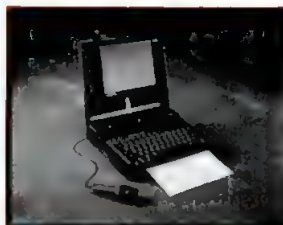
To close the Miniscript window press Esc, and then press F8 to close the table image. As you can see, the Miniscript window can be very handy indeed for experimenting with PAL.

MODIFYING MAXWIN() Mr. Borgers's MaxWin() function is intended to be called when you know for sure that a current window exists and that it holds a Display image in either Table or Form view. If you attempt to execute the function when this condition doesn't hold—as when you first start Paradox—an error occurs, and you'll encounter the Script Break menu. The reason is that the IS-

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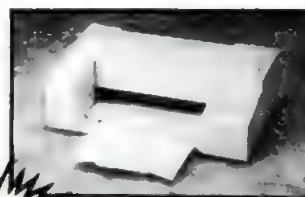
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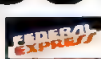
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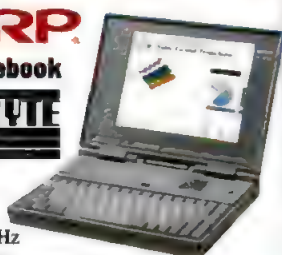
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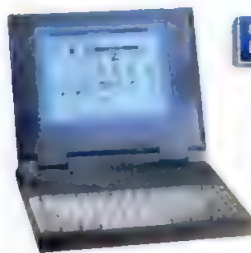


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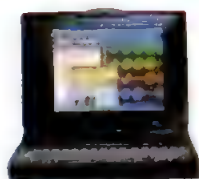
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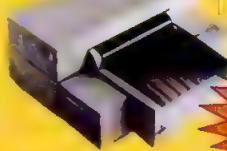
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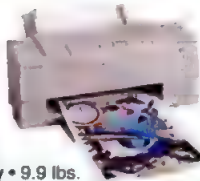
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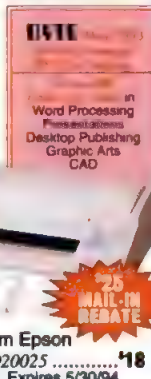
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FORMVIEW() function, used in MaxWin() to determine if the current window holds a form, triggers an error if there isn't a current query image or current table image in Table or Form view on the workspace. To avoid this situation, I've simply generalized the function slightly by employing the IsWindow() and Imagetype() functions. The modified procedure is listed in Figure 4.

The IsWindow() function is used to determine if a window handle is valid. In the new version of MaxWin(), called MaxWin1(), I maximize the current window only if IsWindow() says that the current window handle, as returned by GetWindow(), is valid. Note that the current window handle is 0 when no windows are available, in which case IsWindow() returns False, and the function does nothing.

The Imagetype() function is employed to ensure that conditions are right for calling ISFORMVIEW(). This prevents the Script Break error discussed above. You should also note that MaxWin1() can be used to maximize canvas windows that were created using the WINDOW CREATE command, while the original MaxWin() cannot.

MaxWin() and MaxWin1() can be downloaded from PC MagNet. Look for MAXWIN.SC in the Utilities/Tips Forum.—*Sal Ricciardi*

►**PC MAGAZINE:** A lot of people are still confused over the role of NT, and there's even more confusion over the Advanced Server, which is an NT application that adds naming and security schemes for large installations with many subnetworks.

Microsoft's networking strategy is simple: All nodes should run some form of Windows, and all computers running Windows can act as both clients and servers simultaneously. Few people really need Windows NT even if they fully adopt Microsoft's networking strategy. NT has three major benefits: multitasking, multiprocessor capability, and high security; it also has built-in, network client/server capabilities. But if you run only typical DOS and Windows applications, you don't need NT.

The best operating system for all Windows and DOS applications with or without a network is Windows for Workgroups, Version 3.11. This latest release of Windows includes 32-bit memory access and 32-bit disk I/O, which you don't get in Windows 3.1. Version 3.11 also includes network client/server capabilities that interoperate perfectly with Windows NT. However, you need a PC with at least a 33-MHz 486 or 386 processor and at least 8 megabytes of memory to use Windows for Workgroups effectively.

To answer your question directly, there's no way to run the Windows network drivers without running Windows, but Microsoft does make client software available for PCs that run only DOS. If you want DOS PCs to act as both clients and servers and to interoperate with Windows for Workgroups and Windows NT clients and servers, then you can use Performance Technology's POWERlan networking system. POWERlan also provides excellent network printing utilities on DOS PCs.—*Frank Derfler, Jr.*

USING NOVELL'S ODI DRIVERS

❓I've been using the standard IPX (Internet Packet Exchange) drivers on my NetWare 3.11 network, and I'm happy

with them. Is there any reason I should move to Novell's Open Datalink Interface (ODI) drivers? Am I missing anything?

*James Walsh
South Bend, Indiana*

►**PC MAGAZINE:** If you don't intend to expand or upgrade your network anytime soon, then stay with what you've got. But if you anticipate any growth, there are several

advantages to using ODI drivers instead of IPX protocol stacks generated for each LAN adapter card.

First, Novell has literally abandoned the customized IPX stack system. Updates will come only from adapter manufacturers, and Novell generally begrudges the ef-

fort and wants you to move to ODI.

Second, ODI drivers allow you to use multiple protocols over the same network interface card. For example, you might want some users to access both NetWare servers using IPX and SNMP (Simple Network Management Protocol) management services using the TCP/IP protocol stack. You can load both kinds of protocol stacks over ODI, and they will share a single adapter without conflicts.

Finally, from a practical point of view, even if you never need to load multiple protocol stacks and don't want to update your software, chances are good that a LAN adapter will eventually fail, or perhaps you'll only suspect a failure and want to swap it out to check. If you are using an adapter-specific IPX protocol stack and want to swap out a network board, you must generate (or locate) the appropriate IPX for the board. But using Novell's IPXODI, you load a program called LSL.COM, then a driver (such as SMC-PLUS.COM, NE2000.COM, or 3C509.COM) that is supplied with the board, and then IPXODI and NETX. The only changes you need to make are to the NET.CFG (the IPXODI equivalent of SHELL.CFG) in order to indicate the correct link driver and to the bind statement. Using ODI makes it much easier to swap boards or to add new boards to the network.—*Frank Derfler, Jr.*

*Novell's Open Datalink
Interface makes it much
easier to swap boards
or to add new boards
to the network.*

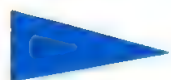
Networking

WINDOWS NT ON A NETWORK

❓Windows NT is being touted as a substitute for Novell's NetWare or for LANtastic as a network operating system, but I keep reading about the horsepower it takes to run NT. To convert from NetWare to Windows NT, do you have to upgrade all of the existing workstations to cope with the needs of the new system? Given the number of old 8088s, 286s, and 386SXs currently serving as print servers or simple word processing workstations on NetWare networks, upgrading would make converting to Windows NT a very expensive proposition in spite of Microsoft's bargain-basement pricing.

*Niall MacDonald
via CompuServe*

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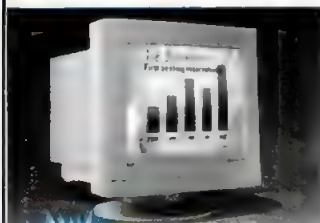
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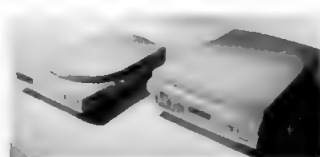
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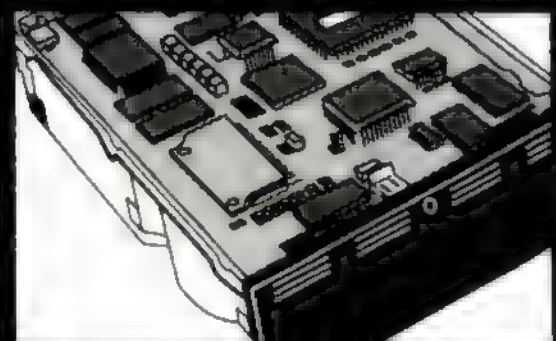
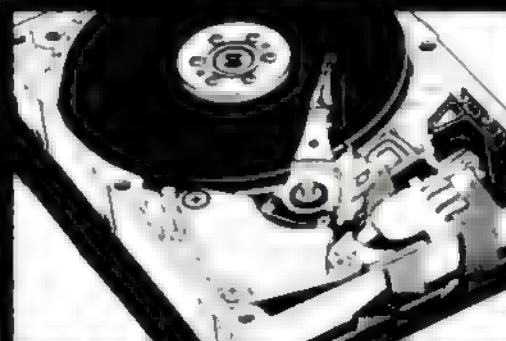
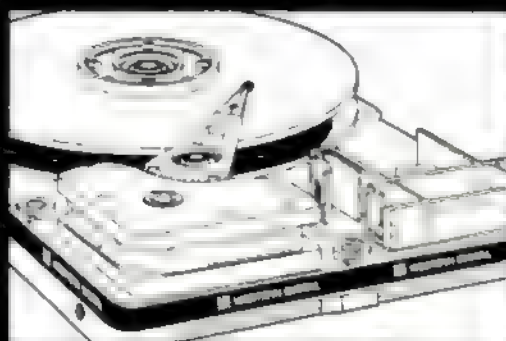
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SCSI			
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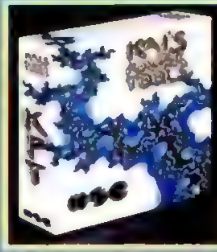
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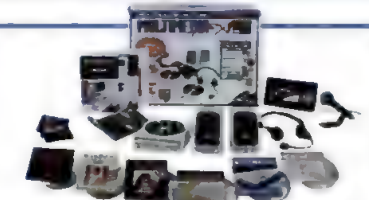
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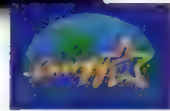
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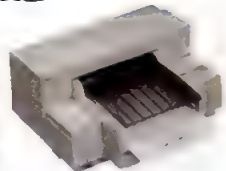
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Adaptec AHA-2842 SCSI-2 vEISA w/Par	259
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Boca IDE 2-HDD, 2-FDD 2-ser 1-par	49
Ultrastar 34F VESA Local Bus SCSI-2	289

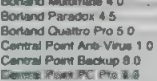
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486DX2/66 Multi-Media Hardware Feature Comparison

Feature	VTech	DELL	Gateway	ZEOS
Memory	8MB	8MB	8MB	8MB
Hard Drive	426MB	450MB	424MB	426MB
Floppy Drives	3.5"	3.5"	3.5"	3.5"
Video	1MB VLB	1MB VLB	1MB VLB	1MB VLB
3 Year Warranty	Yes	No	No	No
Double Speed CD-ROM	Yes	Yes	Yes	Yes
Sound Card & Speakers	Yes	Yes	Optional (\$132)	Optional (\$148)
Modem	Yes	Optional (\$79)	Optional (\$49)	Optional (\$49)
Remote Diagnostics Sftw.	Yes	No	No	No
Case	Full Size	Desktop	Baby AT	Desktop
External Cache	128K	128K	128K	No
Monitor	15"	15"	15"	Upgrade (\$95)
PC Computing Service	★ ★	★ ★	★ ★	★ ★
Value Rating (Aug 1993)	★ ★ ★	★ ★	★ ★	★ ★
Price	\$2199	\$3074	\$2476	\$2762

The VTech Multi-Media systems are available with VTech's integrated local bus or with our new VESA local bus. Each system also includes Compton's Interactive Encyclopedia, Webster's Dictionary and World Atlas which will turn your computer into a complete information center for the whole family.

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- With over 11,000 employees and 3 research and engineering labs VTech has the technology and resources to build incredible systems.
- Our prices are among the lowest in the industry because we supply systems to some of the largest manufacturers in the world and that helps us keep production high and prices low.
- 3 year warranty - PC Computing gave VTech a 5 Star Service Value Rating beating out Dell, Gateway, ZEOS, IBM and Compaq.



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- Double Speed CD-ROM
- Stereo Sound Board
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- 3.5" Diskette Drive
- 14" VTech HiRez Monitor
- Full Size Metal Desktop Case
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- Remote Diagnostics Software
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- Stereo Sound Board
- Compton's Interactive Encyclopedia, Webster's Dictionary and World Atlas
- VLB Graphics with 1MB
- 3.5" Diskette Drive
- 15" VTech HiRez Monitor
- Full Size Metal Desktop Case
- Dual Cooling Fans
- 9600/2400 Data/Fax Modem
- Remote Diagnostics Software
- MS-DOS 6.2 & Windows 3.1
- Enhanced 101 - Keyboard & Mouse
- 3 Year Warranty

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\$1899 with 486DX2/50

Expo 486DX2/50VM

- Intel Verified: for the Pentium™ OverDrive™ Processor
- 8MB RAM with 128KB Cache
- 424MB 13ms IDE Hard Drive
- Double Speed CD-ROM
- Stereo Sound Board
- Compton's Interactive Encyclopedia, Webster's Dictionary and World Atlas
- VLB Graphics with 1MB
- 3.5" Diskette Drive
- 15" VTech HiRez Monitor
- Full Size Metal Desktop Case
- Dual Cooling Fans
- 9600/2400 Data/Fax Modem
- Remote Diagnostics Software
- MS-DOS 6.2 & Windows 3.1
- Enhanced 101 - Keyboard & Mouse
- 3 Year Warranty

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Expo 486DX2/66VM

- Intel Verified: for the Pentium™ OverDrive™ Processor
- 16MB RAM with 128KB Cache
- 527MB 12ms IDE Hard Drive
- Double Speed CD-ROM
- Stereo Sound Board
- Compton's Interactive Encyclopedia, Webster's Dictionary and World Atlas
- VLB Graphics with 1MB
- 3.5" Diskette Drive
- 15" VTech HiRez Monitor
- Full Size Metal Desktop Case
- Dual Cooling Fans
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The ExpoTech family of VESA systems is available with a wide range of processors, hard drives and memory combinations. All VTech systems are covered by a 3 year warranty and include the extra features and support VTech is known for.

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- ♦ Novell Certified
- ♦ Advanced case design with dual cooling fans
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- Full Size Metal Desktop Case
- Dual Cooling Fans
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- MS-DOS 6.2 & Windows 3.1
- Enhanced 101 - Keyboard & Mouse
- 3 Year Warranty

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- Intel Verified: for the Pentium™ OverDrive™ Processor
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- VLB Graphics with 1MB
- 3.5" Diskette Drive
- 14" VTech HiRez Monitor
- Full Size Metal Desktop Case
- Dual Cooling Fans
- 9600/2400 Data/Fax Modem
- Remote Diagnostics Software
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- Enhanced 101 - Keyboard & Mouse
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- Intel Verified: for the Pentium™ OverDrive™ Processor
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- 3.5" Diskette Drive
- 15" VTech HiRez Monitor
- Full Size Metal Desktop Case
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Expo 486DX2/66V

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- 3.5" Diskette Drive
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- Full Size Metal Desktop Case
- MS-DOS 6.2 & Windows 3.1
- Enhanced 101 - Keyboard & Mouse
- 3 Year Warranty

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Platinum 486DX2/66

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- Intel Verified: for the Pentium™ OverDrive™ Processor
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- 424MB 13ms IDE Hard Drive
- Double Speed CD-ROM
- 256KB Copy Back Cache w/Cast Out Buffering
- SCSI II w/ built-in BIOS support
- 16550 Serial Port Controllers
- Multiprocessor Upgrade Slot
- S3 VLB Accelerator with 1MB
- 3.5" Diskette Drive
- 15" VTech HiRez Monitor
- Full Size Metal Desktop Case
- MS-DOS 6.2 & Windows 3.1
- Enhanced 101 - Keyboard & Mouse
- 3 Year Warranty

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Platinum 486DX2/66

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- Intel Verified: for the Pentium™ OverDrive™ Processor
- 16MB RAM
- 527MB 12ms IDE Hard Drive
- Double Speed CD-ROM
- 256KB Copy Back Cache w/Cast Out Buffering
- SCSI II w/ built-in BIOS support
- 16550 Serial Port Controllers
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- 3.5" Diskette Drive
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- Full Size Metal Desktop Case
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- Full Size Metal Desktop Case
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- Remote Diagnostics Software
- MS-DOS 6.2 & Windows 3.1
- Enhanced 101 - Keyboard & Mouse
- 3 Year Warranty

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Expo 486DX33

- Pentium Technology Ready
- 4MB RAM with 128KB Cache
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- Local Bus Graphics with 1MB
- 3.5" and 5.25" Diskette Drive
- 14" VTech HiRez Monitor
- Full Size Metal Desktop Case
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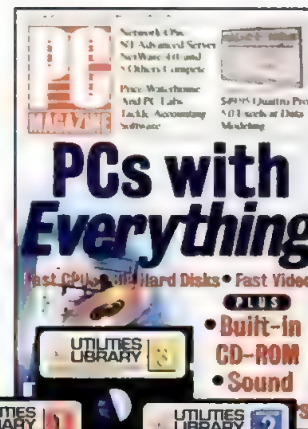
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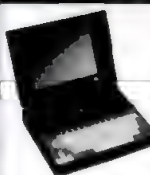
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458	458	458	458	458	458
438	438	438	438	438	438
384	384	384	384	384	384
308	308	308	308	308	308
298	298	298	298	298	298
208	208	208	208	208	208
154	154	154	154	154	154
132	132	132	132	132	132
144	144	144	144	144	144
98	98	98	98	98	98
72	72	72	72	72	72
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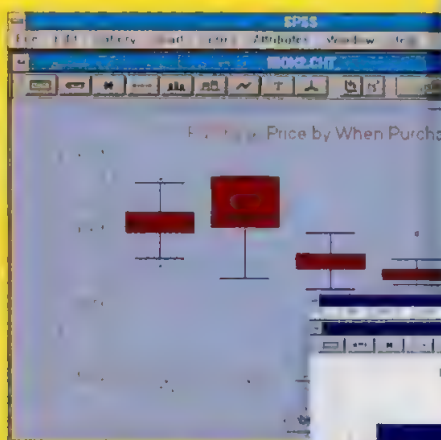
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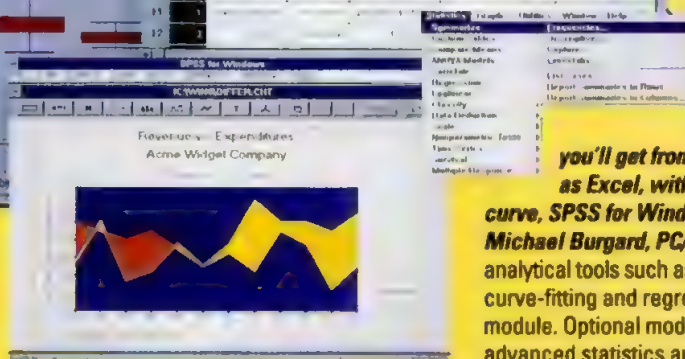
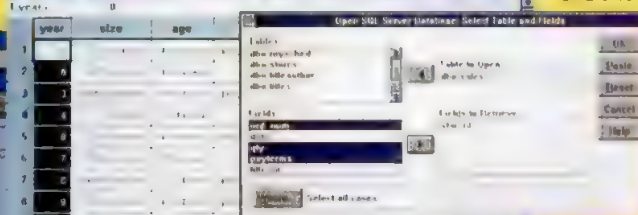
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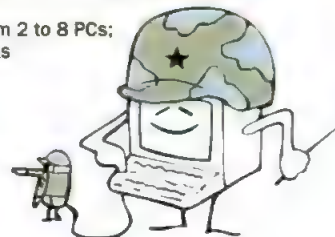


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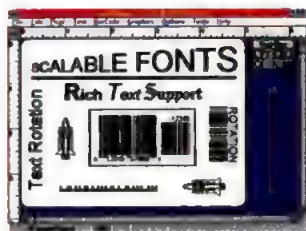
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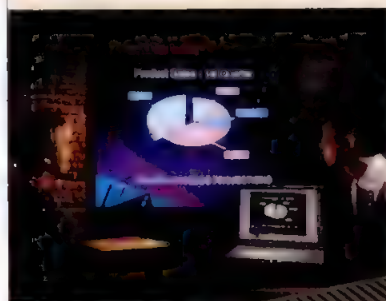
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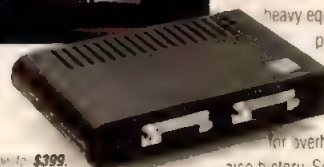
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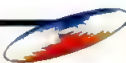
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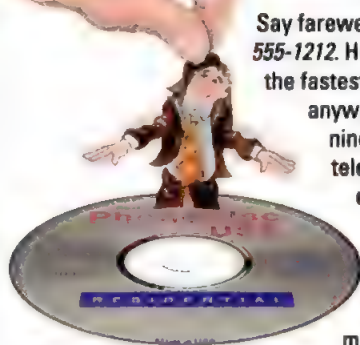


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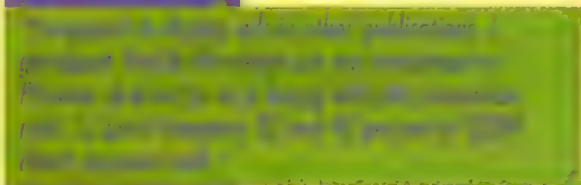
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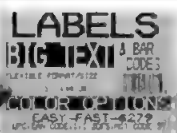
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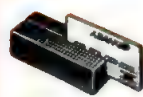
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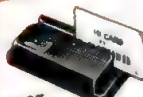
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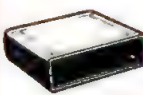
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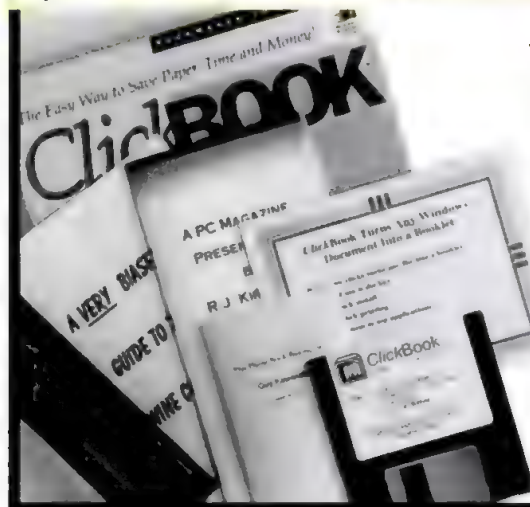
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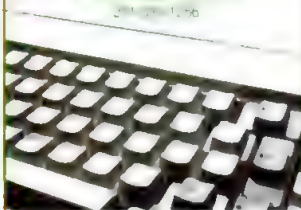
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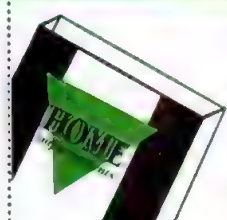
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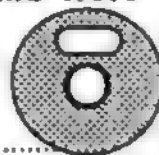
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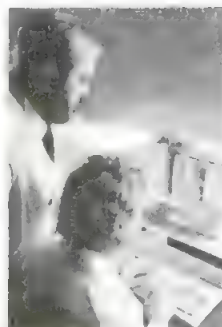


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1. Do you work in a DPMIS dept.?
01. ☐ Yes 02. ☐ No

2. Please indicate your company or organization's primary business activity: (Check one)

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02. ☐ Manufacturer-Aerospace
03. ☐ Manufacturer-Other
04. ☐ Systems House
05. ☐ Computer Consultant
06. ☐ Computer Retailer/VAR/VAO Distributor
07. ☐ Communications
08. ☐ Finance/Banking/Insurance/Real Estate/Accounting
09. ☐ Education
10. ☐ Government
11. ☐ Research and Development
12. ☐ Data Processing/Computer Service
13. ☐ Health/Medical/Legal Service
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16. ☐ Agr./Const./Mining/Oil/Transp./Utilities
17. ☐ Non-Computer Retailer/Dist.
18. ☐ Other Business or Service

3. Please indicate your primary business function: (Check one)

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03. ☐ Communications
04. ☐ Engineering
05. ☐ Res./Dev./Scientific
06. ☐ Accounting/Finance
07. ☐ Computer Consulting
08. ☐ Purchasing
09. ☐ Operations
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11. ☐ Education/Training
12. ☐ Marketing/Sales
13. ☐ Medical/Legal
14. ☐ Admin./Mgmt.

4. Is your company a reseller?
01. ☐ Yes 02. ☐ No

5. For how many IBM PCs and compatibles do you specify brands of products:

01. ☐ 10 or less 03. ☐ 26-99
02. ☐ 11-25 04. ☐ 100 or more

6. Are there any PCs in your office?

01. ☐ Linked to mainframes
02. ☐ Linked to mini
03. ☐ Networked together

7. Please check the equipment currently installed at your location: (Check all that apply.)

01. ☐ IBM or Compatible PCs
02. ☐ IBM or Compatible Mainframes
03. ☐ IBM or Compatible Minis
04. ☐ Macintosh
05. ☐ CD-ROM
06. ☐ Windows

8. Do you plan to buy any PC products?

01. ☐ Now 03. ☐ In 7 to 12 months
02. ☐ In 4 to 6 months 04. ☐ No definite plans

9. Number of employees in your entire company:

01. ☐ 25 or less 03. ☐ 100-499 05. ☐ 1000 or more
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01. ☐ Yes 02. ☐ No

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06. ☐ Windows

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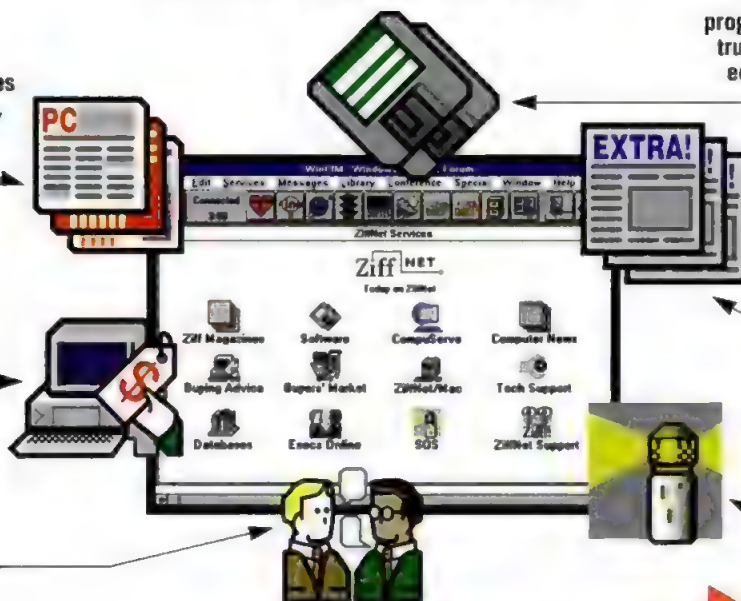
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Coming Up

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How much system memory do you really need? How much should satisfy you? PC Magazine Labs tests OS/2, Windows, and Windows NT with 4MB, 8MB, 16MB, and 32MB of memory to tell you what kind of performance you can expect.

Desktop Publishing

Not all desktop publishing programs are alike: Business users who design newsletters and brochures have different needs from professional publishers. We look at both professional- and business-level DTP software to help you choose.

Personal Information Managers

PIMs range from simple to complex, with the heavyweights able to handle almost any kind of data. We evaluate 14 Windows- and OS/2-based PIMs for their capacity to manage contacts, personal calendars, and free-form information. The object: to organize as much information as possible in the cleanest, least-cluttered environment. It's a mission few PIMs can handle.

CD-Recordable Drives

CD-ROM publishing used to require thousands of dollars and the services of a mastering and replication plant. Today you can purchase a desktop CD-R drive and software for as low as \$4,000 and create your own CDs for about \$20 each. We test ten CD-R hardware/software packages for performance and ease of use.

Custom Controls for Visual Basic

When Microsoft created Visual Basic's custom-control architecture, it opened the floodgates for a surge of third-party add-ons. Today, hundreds of custom controls—plug-in software extensions to the Visual Basic Toolbox—let you put specialized features into your programs without having to write the underlying code. We review some that add database access, graphics, multimedia—or just fancy widgets—to your Visual Basic project.

Tutor

So you're at a cocktail party and the blowhard next to you says his operating system is better than yours because it uses studly preemptive multitasking instead of wimpy cooperative multitasking. Is this the nineties version of getting sand kicked in your face? In our Tutor column, Windows muscleman Jeff Proise explains why the right kind of multitasking makes your Windows apps behave themselves.

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After Hours

Skill Builders: Yearn 2 Learn Peanuts, Thinkin' Things, Reader Rabbit 3, Math Blaster: In Search of Spot;
CD-ROM Pick Hit: The Anglo-Saxons; **Children:** KidDesk (Family Edition);
Adventure: BloodNet; **Spotlight On Fitness:** ExerCitement, DynaPulse 200M-Win

SKILL BUILDERS

Teaching Children the Three Rs (with a Smile)

BY CHARLES TAFT

Challenging the imagination of a young child can be a daunting task. Here are four new user-friendly, skills-oriented entertainment programs that will keep your child enthused and amused while he or she is learning. Two of the programs are sequels of sorts to existing story lines, proving that (in the right hands) a sequel *can* be as enjoyable as the original; the other two programs seem well on their way to becoming classics, too.

Yearn 2 Learn Peanuts lets you or your children explore five activity centers with Snoopy, Charlie Brown, and the rest of the *Peanuts* gang. Children can choose among sections of the program called Comic Strips, Flying Ace Games, Geography Games.

Math Games, or Coloring Book. Yearn

2 Learn is recommended for ages 3 to 10, and the level of difficulty varies enough to keep kids challenged as they progress through that age range.

The activities in this Windows-based program are thoughtfully designed and just plain fun. For example, the Comic Strips section, which uses digitized speech and graphics to teach reading skills, contains five animated stories, including a Marcy and Peppermint Patty vignette entitled "Girls Love Football." The program reads the words to the comic strips aloud so younger nonreaders can explore the section on their own. To make things even more interesting for older children, each frame contains hidden hot spots that animate when pressed—at the end of each strip, the program

tells you how many hot spots you found and displays this



COMIC STRIPS: Marcy and Peppermint Patty make learning to read fun in *Yearn 2 Learn Peanuts*.

number graphically as a percentage of the total number of hot spots in the strip. The Geography Game helps players learn the names of the various states as they place those states in the right locations to solve a jigsaw puzzle. Don't you wish they taught geography this way when we were kids!

If you think your youngster enjoys dreaming up things to do now, wait until he or she tries **Thinkin' Things**. Designed for the fertile imaginations of 4- to 8-year-old children, *Thinkin' Things* offers six activities to delight and challenge. Oranga Banga's a one-

orangutan band—he'll play the rhythms you compose, or he'll ask you to play his tunes. Toony Loon's a xylophone player who needs your help in creating melodies using glasses, hollow logs, and strings as instruments. The Feathered Friends challenge you to make patterns from 2-D objects, while the 3-D BLOX activities ask you to create patterns and art using flying shapes and spheres. In the Fripplie Shop, children use Boolean logic to create bizarre things called Fripplies.

As with other Edmark Corp. programs, many *Thinkin' Things* activities offer both

Yearn 2 Learn Peanuts, \$64.95. Requires: Microsoft Windows 3.1, 12MB hard disk space, sound card. Image Smith, 1313 Sepulveda Blvd., Torrance, CA 90501; 800-876-6679. Circle 515 on reader service card

Thinkin' Things, \$59.95. Requires: 640K RAM, Sound Blaster-compatible sound card. Edmark Corp., 6727 185th Avenue NE, P.O. Box 3218, Redmond, WA 98073; 800-426-0856. Circle 516 on reader service card

Reader Rabbit 3, \$59.95. Requires: 640K RAM, 3MB hard disk space; sound card recommended. The Learning Company, 6493 Kaiser Drive, Fremont, CA 94555; 800-852-2255. Circle 517 on reader service card

Math Blaster: In Search of Spot, \$59.95. Requires: 640K RAM, 7MB hard disk space. Davidson & Associates, 19840 Pioneer Avenue, Torrance, CA 90503; 800-545-7677. Circle 518 on reader service card

After Hours

Create Mode, in which you decide what to do, and Question and Answer Mode, in which the program asks you to perform certain tasks. The users' guide contains many suggestions for continuing to develop children's skills outside the program, and the program's Adult Section enables parents to set the activities' Grow Slides (difficulty levels) for your child. Parents can also choose to let the program self-adjust the Grow Slides depending on the rate of their child's progress.

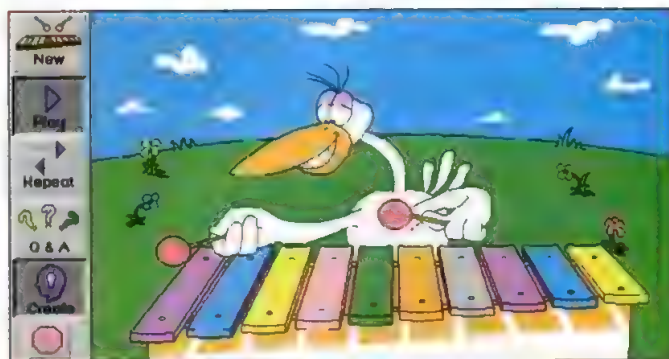
Hop to it! In Reader Rab-

Skywriter. In this tale, you work with Reporter Rabbit (aka Reader Rabbit) on four activities: What's the Scoop?, where young readers identify the who, what, where, and when of a sentence; Clue Hounds, where kids pick out the various grammatical components of a sentence; Sneak Peak, where they learn to put sentence parts into proper order; and Ed Words, where they practice their reporter skills with the Skywriter's editor. Finally, children go to the Printing Press, where they can write and print their own stories.

Reader Rabbit 3 is fun to play. Children meet exciting characters such as the Clue Hounds (Orville and Wilma Write), Sneaker Mole (the paper's film critic), and the editor, Ed Words, as they learn more about writing.

There are over 200 stories to keep young reporters engrossed, the animations are delightful, and the program offers four levels of play for each of the four activities.

In **Math Blaster: In Search of Spot**, the Blasternaut's



LOGIC: Thinkin' Things encourages young children to develop problem-solving skills while they're making music.

trusty sidekick, Spot, has been captured by the Trash Alien. You must help the Blasternaut free him, in this latest addition to the renowned Math Blaster series. In the ten years that Math Blaster programs have been on the market, they've become a hit with children ages 6 to 12; and the newest program, Math Blaster: In Search of Spot, is a major upgrade that multiplies the fun for young players. The program is divided into four activities: Trash Zapper, Number Recycler, Cave Runner, and Math Blaster, all of which enable students to refine their mathematics skills in an arcade environment without the pain of traditional skill-and-drill exercises. The program offers

over 50,000 math problems, adds superb high-resolution graphics, and continues the Davidson & Associates theme of encouraging children to help the environment.

Children who've played New Math Blaster Plus will immediately notice the enhancements in this latest in the series. There's substantially more action and adventure involved in this program, and there are more math problems to solve; the Blasternaut even has a new, leaner look. The program will keep children busy: It offers six levels of difficulty within seven subject areas, and parents can use the program's editor to create tailored exercises for players.



SOLVE IT: Help the Math Blaster free his trusty sidekick, Spot, from the Trash Alien.

bit 3, your children's favorite hare has a new job. The generation of 6- to 9-year-olds who have grown up with Reader Rabbit can now help him on his job as an investigative reporter for the Wordville Daily

stories to keep young reporters engrossed, the animations are delightful, and the program offers four levels of play for each of the four activities.

In **Math Blaster: In Search of Spot**, the Blasternaut's

The Anglo-Saxons Brings the English Past Back to Life

The Anglo-Saxons proves that the days of warrior kings may be gone, but it's not forgotten. If you long for a glimpse of the England of Beowulf, you'll find no better guide than The Anglo-Saxons. This multimedia reference offers a tour through history using images from the British Museum's collection, as well as maps of historical sites, samples of Anglo-Saxon music, Old English narration and the full text of important literary works from the period, including Beowulf. You can visit archaeological digs, explore the art and culture of the kings, and learn about places to visit on your next trip to modern-day England, all without leaving the comfort of your living room.—Gayle C. Ehrenman.

The Anglo-Saxons, \$59.95. Cambrix Publishing; 818-992-8484.

Circle 519 on reader service card



After Hours

CHILDREN'S SOFTWARE

Kidproof Your Home PC

BY CHARLES TAFT

If you share a PC with your children, KidDesk (Family Edition), the latest incarnation of the popular KidDesk desktop manager and program launcher, can help ensure that the kids aren't roaming around the hard disk, accidentally trashing the family checkbook. As its name implies, KidDesk (Family Edition) provides useful features and enjoyment for the whole family.

Adult and junior users can choose

from 12 personalized desktops, send e-mail to each other, file away important numbers in the card file/address book, and take notes in a pad that offers a selection of borders and type styles. The program also contains voice-recording ability for



SAFETY: Keep the kids out of the family files with KidDesk.

sending messages to family members, an adult password selection feature for locking out unwanted users, and a versatile calendar maker for tracking busy social schedules.

Younger children will especially appreciate the user-friendly icon interface, while older children will delight in the personalization options. And best of all, parents will get the warm, comforting feeling that comes from a security blanket—in this case, for the hard disk.

KidDesk (Family Edition), \$59.95.
Requires: 4MB RAM, Microsoft Windows 3.1.
Edmark Corp.,
800-426-0856.

Circle 522 on reader service card

ADVENTURE

BloodNet: A Cyberpunk Gothic

BY BARRY BRENESAL

In BloodNet's vision of Manhattan, circa 2094 A.D., every problem has spiraled out of control. Arms merchants, mercenaries, street gangs, and drug dealers rule the disintegrating landscape. Law and order have retreated to the megacorporate offices of TransTechnical, a combination CIA, phone company, international bank, and software giant. Disease, famine—what plague has bypassed NYC? Vampires? No, they're in the mix, too, in

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After Hours

this high-tech cyberworld.

BloodNet's graphics tend to be black and grey, in keeping with its necropolis-like setting. What gives this game its own peculiar flavor—even more than the detail and mood of the graphics—is the language. It's an elaborate cyber-slang that reflects new technologies, global culture, and fragmented personal identities.

You play one of those fragmented personalities: Ransom Stark, a freelance mercenary who works the underside of TransTechnical's worldwide computerized network and its virtual reality interface. Recently bitten by a vampire (and the powerful Chairman van Helsing of TransTechnical, no less), your character is



BLOODNET: Blade Runner meets Dracula in this gothic adventure, set in Manhattan circa 2094.

still half-human but fading fast. Your job is to fight the undead and search for clues that will end the vampire's curse, all while saving the city and humanity from van Helsing.

This is a curious gaming hybrid, combining elements of

role-playing and graphics adventures. As is typical in role-playing games, you start by creating a team with six different characters, each with an inventory and an elaborate set of personal stats and battle traits. The characters

act independently, volunteering for the work for which they're best suited. But the way you navigate the game is more typical of a graphics adventure: Your team moves from subway stop to subway stop, initiating lengthy conversations with residents. Along

the way, you must find objects to exchange for valuable weaponry, armor, and information. There's even a dialog replay button if you miss something vital to your existence.

Highly original and well-written, BloodNet: A Cyberpunk Gothic is an absorbing vision of a potential future. Look beyond the reality of the scenario (or lack thereof); just go with the game instead.

BloodNet: A Cyberpunk Gothic, \$69.95. Requires: 2MB RAM, DOS 5.0 or later, 9MB hard disk space; audio card recommended. Microprose Software Inc., 180 Lakefront Dr., Hunt Valley, MD 21030-2245; 410-771-1151.

Circle 523 on reader service card

Giving Your PC (and Your Heart) a Workout

by Jeff Greenberg

Spending too much time in front of your PC might be bad for your health, unless you're using ExerCitement from The Computer Athlete. This package turns your PC and any ordinary piece of cardiovascular exercise equipment into an interactive video game.

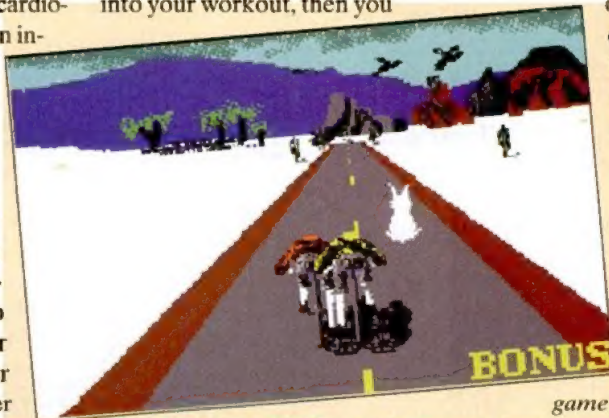
The kit comes with software, an electric eye, and a reflector. You place the hardware near your treadmill, exercycle, stair climber, or rowing machine so each step or stroke you take breaks the beam and triggers the software. The software then monitors your pace to move an on-screen character through a race course. The faster you pedal, row, or climb, the faster your character moves.

You steer your character using a set of buttons that attaches with velcro to the handles of your exerciser. You must avoid obstacles along the way, but if you bump off a competitor, you earn extra points.

The kit comes with all of the cables, buttons, and velcro you'll need. The pieces are well-marked, making installation and setup a snap. The only challenge

is routing the cables around your equipment. Fortunately, an adequate supply of velcro strapping makes this less treacherous than it might be.

If you are going to put all that effort into your workout, then you



WORK IT: The faster you pedal that exercycle, the faster your ExerCitement character will move on the road to health.

might as well track the results. Pulse Metric's DynaPulse 200M-WIN lets you do exactly that, tracking your blood pressure via your PC.

The package comes with software, a pressure cuff, a manual squeeze pump,

and an interface box that connects to your PC's serial port. To start monitoring, you simply put the cuff on your arm and inflate it, and the software does the rest. Soon you'll see a graphic depiction of your blood pressure and pulse displayed on your monitor. Even better, the software maintains a database of your blood pressure and pulse over time, so you can see if you are improving or regressing. The DynaPulse can't take the place of your doctor, but it can help you monitor your health on a day-to-day basis.

ExerCitement, \$159.95. Requires: 7K hard disk space, game port, exercise equipment. The Computer Athlete, 5193 Betonywood Place, Dublin, OH 43017; 800-860-4506. Circle 520 on reader service card.

DynaPulse 200M-WIN, \$189. Requires: 4K hard disk space, Microsoft Windows 3.x. Pulse Metric Inc., 10225 Barnes Canyon Rd., Suite A100, San Diego, CA 92121; 800-927-8573.

Circle 521 on reader service card.

SPOTLIGHT ON FITNESS

Abort, Retry, Fail?

THE LIGHTER SIDE OF PERSONAL COMPUTING

By Don Willmott

Block That Metaphor!

It didn't take much effort to find all these annoying Information Highway puns in the nation's newspapers and magazines. One was even in *PC Magazine*.

- Test Run on the Information Superhighway
- Data Starts to Ride the Information Highway
- Do I Need a Driver's License for the Information Highway?
- Traffic Jams Already on the Information Highway
- The Information Highway Needs Traffic Rules
- On-Ramp to the Superhighway
- Information Highway Paved to the Midwest
- A Toll Collector on the Information Highway
- Nationwide Data Highway Faces Speed Bump
- The Information Highway is a Dirt Road
- Driver Training on the Information Highway

ARF Interactive

Are you tired of the Information Highway yet? Who gave it that boring name anyway? Why didn't they call it the Siliconbahn? If you want to help us rename it, send in your best suggestions. We'll pick a winner, and together we'll change the course of history.



Yow! How fast does The Ford Simulator III go in second gear???
(Software Labs catalog.)

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Thomas MacDonald, marketing director, Intel Corp.

From the Land of Planars and Hard Files

Faithful reader Bill Youell reports that when his IBM 2440 tape drive crashed, the IBM technician who came to check out the problem said the drive needed a new AMD. Mr. Youell went to the manual and found out that AMD stands for Air Moving Device. In other words, what we're talking about here is a fan.



Yes, but will it fit in your kitchen?
(Design News.)

Arthur inadvertently replaces his mouse pad with an Ouija board. For the rest of the day, he receives messages from the spectral world.



Richard Tennant

If your entry is used, we'll send you \$50 and a *PC Magazine* T-shirt. Send your entries to Abort, Retry, Fail?, *PC Magazine*, One Park Ave., New York, NY 10016-5802. Winners this issue: J. Scott Avery, Hank Herrmann, Larry Sullivan, and Bill Youell.

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